CIVIL ENGINEERING

JANUARY 1954

THE MAGAZINE OF ENGINEERED CONSTRUCTION

CHICAGO'S CONGRESS STREET SUPERHIGHWAY

SEE ARTICLE BY V. E. GUNLOCK

* **ADVANTAGES OF RAYMOND CONCRETE PILES** Number one of a series

permanency

The L. C. Smith Building as it looks today. It is 500 feet in height and is founded on 1,281 Raymond Piles.

IN 1912 the first Raymond Concrete Piles were driven for one of the country's earliest skyscrapers . . . the 42-story L. C. Smith Building in Seattle. Today, 41 years later, the L. C. Smith Building, towering high above Seattle's skyline, is still the tallest building on the Pacific Coast . . . exemplifying the fact that when you specify Raymond Piles you can be sure of a firm and permanent foundation.

RAYMOND'S DOMESTIC SERVICES . . .

Soil Investigations • Foundation Construction • Harbor and Waterfront Improvements • Prestressed Concrete Construction • Cement-mortar Lining of Water, Oil and Gas Pipelines In Place

RAYMOND'S SERVICE ABROAD . . . In addition to the above, all types of General Construction.

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◀ Two Raymond rigs driving piles for the L. C. Smith Building in Seattle in May, 1912.

When Sewerage Projects are Bond-Financed...

Look for Vitrified CLAY PIPE

When a municipal sewerage project is financed by bonds that won't mature until 1993, the pipe has to be good. It *must* not fail—especially before the bond issue has been retired. That's why city officials and sewerage contractors all over the country confidently specify, buy, and install Vitrified Clay Pipe. They know Clay Pipe is the *only* pipe . . .

- **Completely unaffected by sewage acids and corrosive industrial wastes . . .**
- **Sure to last regardless of the fluids that may flow through it in the future . . .**
- **Guaranteed for 50 years!**

The $27 million bond issue launched by the city of Miami will cover long-needed sewerage improvements that will require hundreds of thousands of feet of Vitrified Clay Pipe. In the 79th St. installation shown here—a small part of the overall project—some 12,000 feet of Clay Pipe were installed. City of Miami officials who directed various phases of this project are: Engineer Arthur E. Darlow, Inspector Frank Allen, and Supervisor of Sewer Design W. B. Lewis. Under the direction of General Contractor Joe Reinertson, Inc., were Design Engineer W. T. Eefting, Job Superintendent Tom Bryson, and Superintendent of Construction Inspection Fred Righter.

Vitrified CLAY PIPE

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C-154-1

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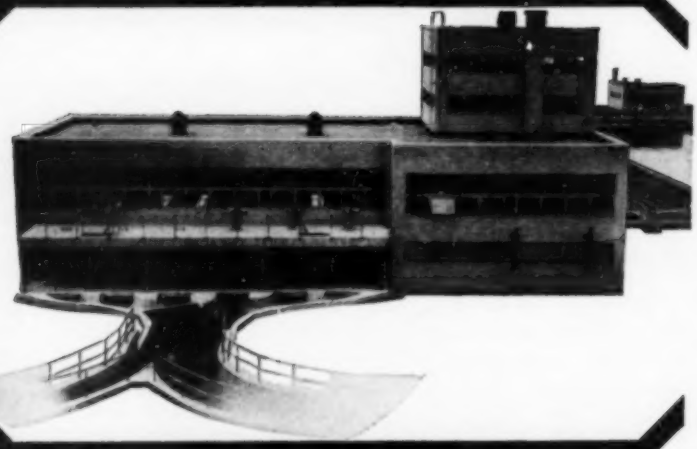
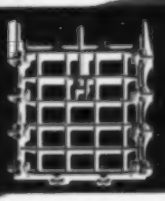
FOR SLUICE GATES
large or small

SPECIFY
RODNEY HUNT





Rodney Hunt cast iron bronze-mounted sluice gates are used throughout this modern sewage treatment plant at Bucklin Point, East Providence, R. I. Here, there are Rodney Hunt gates 96 x 96, 84 x 96, 60 x 72, 48 x 72, 36 x 24, 24 x 36, and 24 x 18; wall thimbles are in place for 19 more gates in sizes up to 96 x 120 to be installed as need arises.

There are 2000 combinations of types and sizes of Rodney Hunt standard cast iron bronze-mounted sluice gates, giving engineers a very wide selection of rectangular clear openings up to 120" x 120" or diameters up to 108". Experienced engineering and traditionally good New England skill in our foundry and machine shop assure trouble-free low-cost operation of Rodney Hunt Sluice Gates. We bid competitively and make firm deliveries to meet construction schedules.

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232 page Catalog

Our elaborate catalog contains photographs, drawings, specifications and descriptions of Rodney Hunt cast iron bronze-mounted sluice gates, timber gates, hoists, valves, racks and rakes.

A 28-page section gives valuable engineering data on hydraulic problems.

This catalog was prepared for consulting engineers, contractors and others *actively* engaged in water control. Write on your letterhead for Catalog WCA-952.

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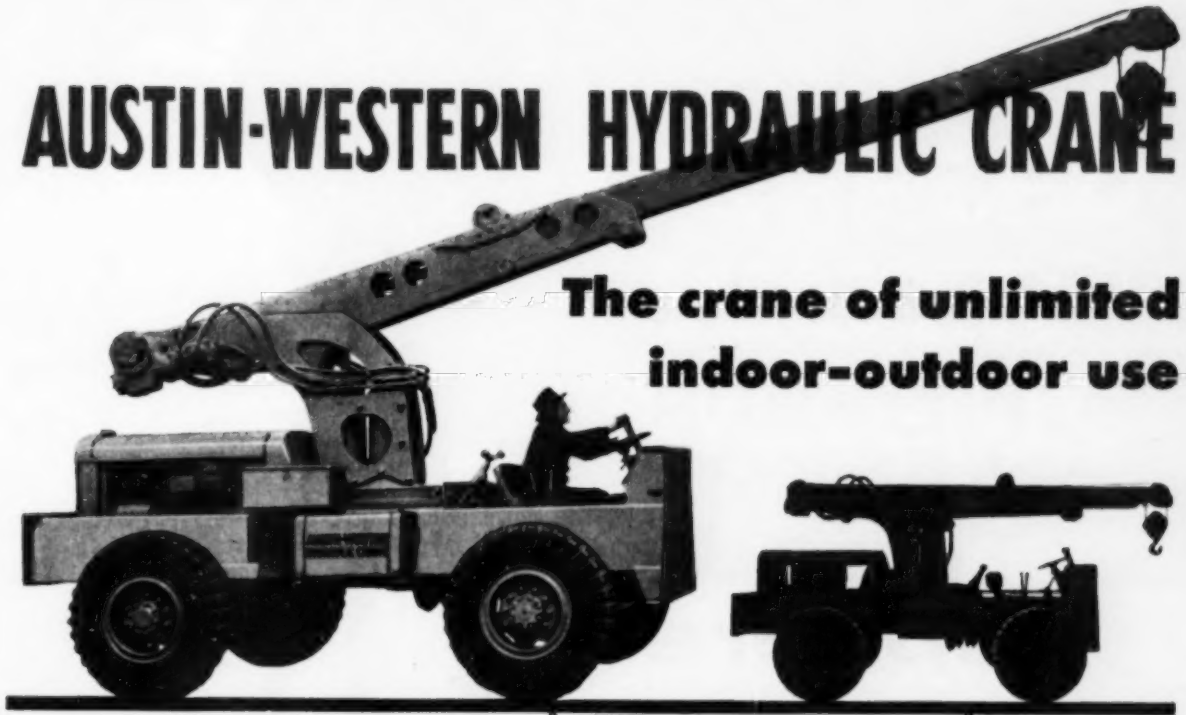
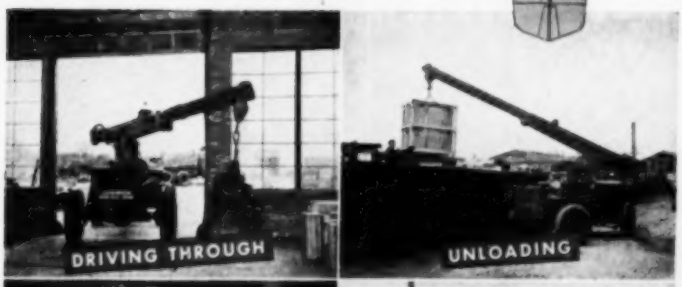


IDEAL FOR USE WITH CLAMSHELL AND MAGNET



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- in design
- in efficiency
- in economy

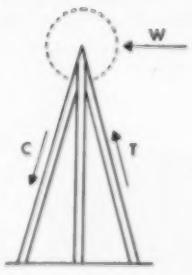
for modern water storage

THE

PITTSBURGH •DES MOINES Tripod-Sphere

PATENT APPLIED FOR

The TRIPOD-SPHERE illustrated, located at Gonzales, California, has 100,000-gallon capacity, with 31 ft sphere, on a 100 ft tower. Head range is 23 ft 1 in. Diagram shows how wind force (W) on sphere places columns in tension or compression, without bending.



This remarkable Pittsburgh-Des Moines development in elevated water storage combines striking appearance with new construction simplicity and economy. • Consisting of an Icosasphere supported by a tubular tripod, the TRIPOD-SPHERE requires no wind bracing members. Because the center of wind pressure on the sphere coincides with the point of intersection of the supporting columns, no bending is introduced. Construction of the TRIPOD-SPHERE is covered by a patent application. • Write for details on this new design in terms of your prospective water storage needs.

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■ Are your water pumps past their prime? Wells showing signs of internal disorders? Better call in Layne for a checkup. Layne water supply specialists can get crippled water systems off their crutches in a hurry.

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Layne repair and maintenance service, backed by 72 years of experience, keeps water supplies up and costs down. Get complete details now from your nearest Layne Associate Company. Or write Layne & Bowler, Inc., Memphis 8, Tenn.

Layne

Water Wells
Vertical Turbine Pumps

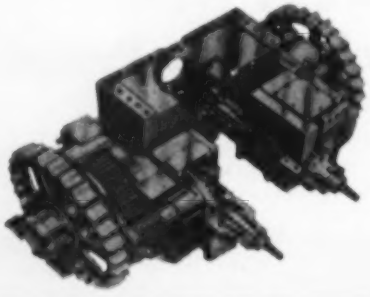
WATER TREATMENT

Layne Associate Companies Throughout The World

THE EIMCO 105 FINAL DRIVE

Eimco's final drive assembly is just one of the new and exclusive features of the new Eimco 105. The Eimco final drive is a rugged heavy-duty assembly made of heavy alloy steel shafts and gears and encased in heavy alloy steel cast housings. The design permits easy access to gearing through side plates. The anti-friction bearings are assembled in cages for perfect fits and longer life.

Notice the absence of troublesome clutches, brakes and gadgets in this sturdy assembly.



Eimco 105 Tractor Excavator is a new heavy-duty machine, thoroughly tested in the field, with all desirable features for a modern prime mover.

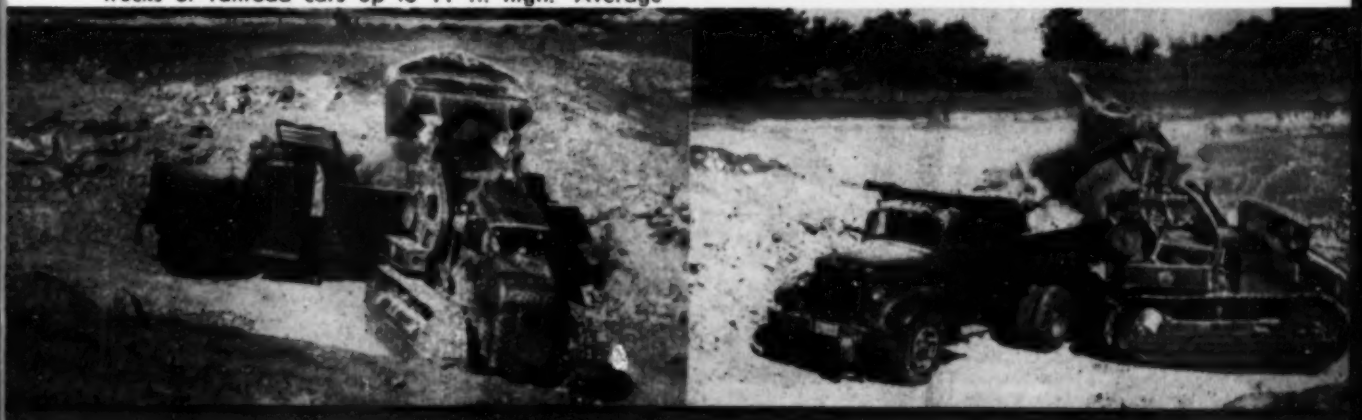
The 105 is a complete departure from ordinary tractor design in appearance and arrangement. The design features permit stronger construction, easier service when necessary and many other operating advantages such as:

1. Freedom from "leveritis" on the pulling and pushing of numerous hand levers, foot clutches, hand brake levers for steering and the necessity of stopping to change speeds or directions. With the 105 you use two small levers (one for each track) that can be held by one hand to give you forward motion — instant reverse or any degree of turn from "spin" turn to "feathered" turn. You can move the speed changing lever from one position to another while in motion under full load.

2. Full track oscillation even with attachments such as the Eimco loader.

3. Controlled loading speed through the Eimco two-speed bucket discharge mechanism. Easy light truck loading in low speed.

(Above right): Eimco 105 excavating material in pit with uneven bottom. This type of digging and loading is impossible with any other economical type equipment. (Above left): Fast moving 105 backs across to place bucket full of rock in truck which is parked on even spot in pit. (Below): The Eimco 105 can load trucks or railroad cars up to 11 ft. high. Average loading speed is 6 - 10 yards per minute in rock. Illustration on opposite page: The Eimco 105 shown here is loading a large truck from the end on a grade of approximately 20%. Two speed loading mechanism (exclusive on Eimcos) permits throwing load all the way back in this type of loading.



THE EIMCO CORPORATION

Salt Lake City, Utah, U.S.A.

Export Office: Scott Bldg., 55 South St., New York City

B-3

4. Complete visibility with the operator well up front where he can see what's going on.

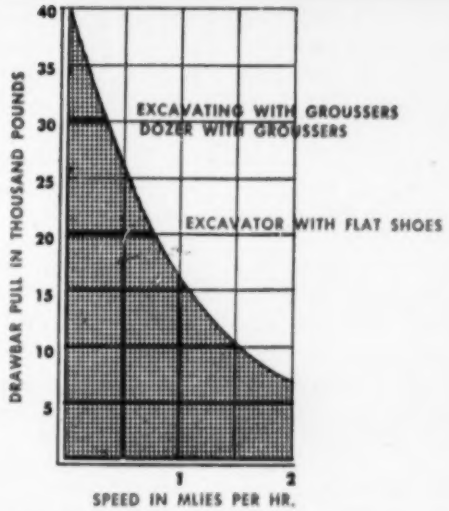
5. Greater production because of its easy handling and greater maneuverability.

6. Clutches never require adjustment.

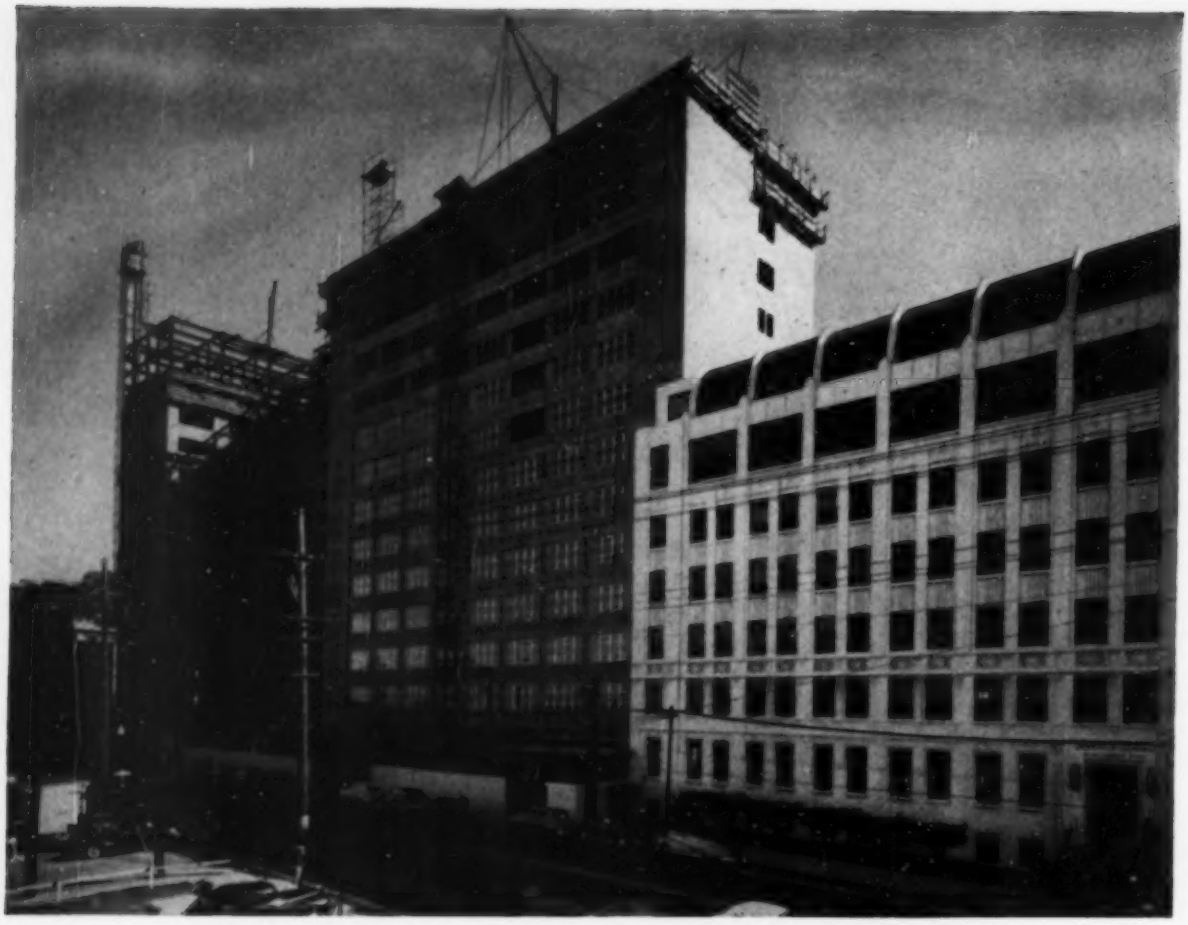
Dependable operation is always a feature of Eimco equipment and in this the Eimco 105 is no exception. We have tried this machine under operating conditions where in a few short hours it has been subjected to more abuse than a high speed contractor can deal out in a month. The 105 can take it.

This rugged construction of the 105 was carefully planned. Every part has been designed for strength. Castings are all alloy steel. Wearing parts have been very carefully heat-treated. Machining tolerances have been held to rigid standards.

In addition to this, new designs have been incorporated in many of the individual pieces in order to give them greater strength, easier accessibility and in many cases to assure many years of operation with absolutely no attention except normal lubrication.



Drawbar pull charts based on preliminary tests shewing relative comparisons.



The Medical Sciences Building at San Francisco as it neared completion, with some unenclosed steelwork still visible at upper left. The adjoining building at right is the Medical Center hospital.

14-Story Medical Building Erected Without Riveting

Construction of the new Medical Sciences Building, teaching unit at the University of California Medical Center in the Sunset district of San Francisco, posed a special problem. For right at the edge of the site were hundreds of hospital patients for whom the clattering of riveting hammers for hours every day would be an ordeal.

To spare the patients, the building's architects, Blanchard and Meyer, called for erection of the steelwork with bolts, and Bethlehem Pacific, West Coast subsidiary of Bethlehem Steel, set in place the 2,000 tons of columns and girders without the rat-tat-tat that commonly signalizes steel going up.

The job required over 70,000 bolts. Some of them came from Bethlehem Pacific plants on the Coast, while others were special high-strength bolts from Bethlehem Steel's plant at Lebanon, Pa.

The Medical Sciences Building is one of the first buildings of this size to have a bolted steel frame. Now the practice of erecting steel structures with bolts is spreading. Buildings with bolted connections are going up in all parts of the country, with resulting saving in time and elimination of riveting noise.

Man at left is not riveting, but tightening nuts on bolts with power-driven wrench. Rivets in lower part of picture had been driven previously, in the shop.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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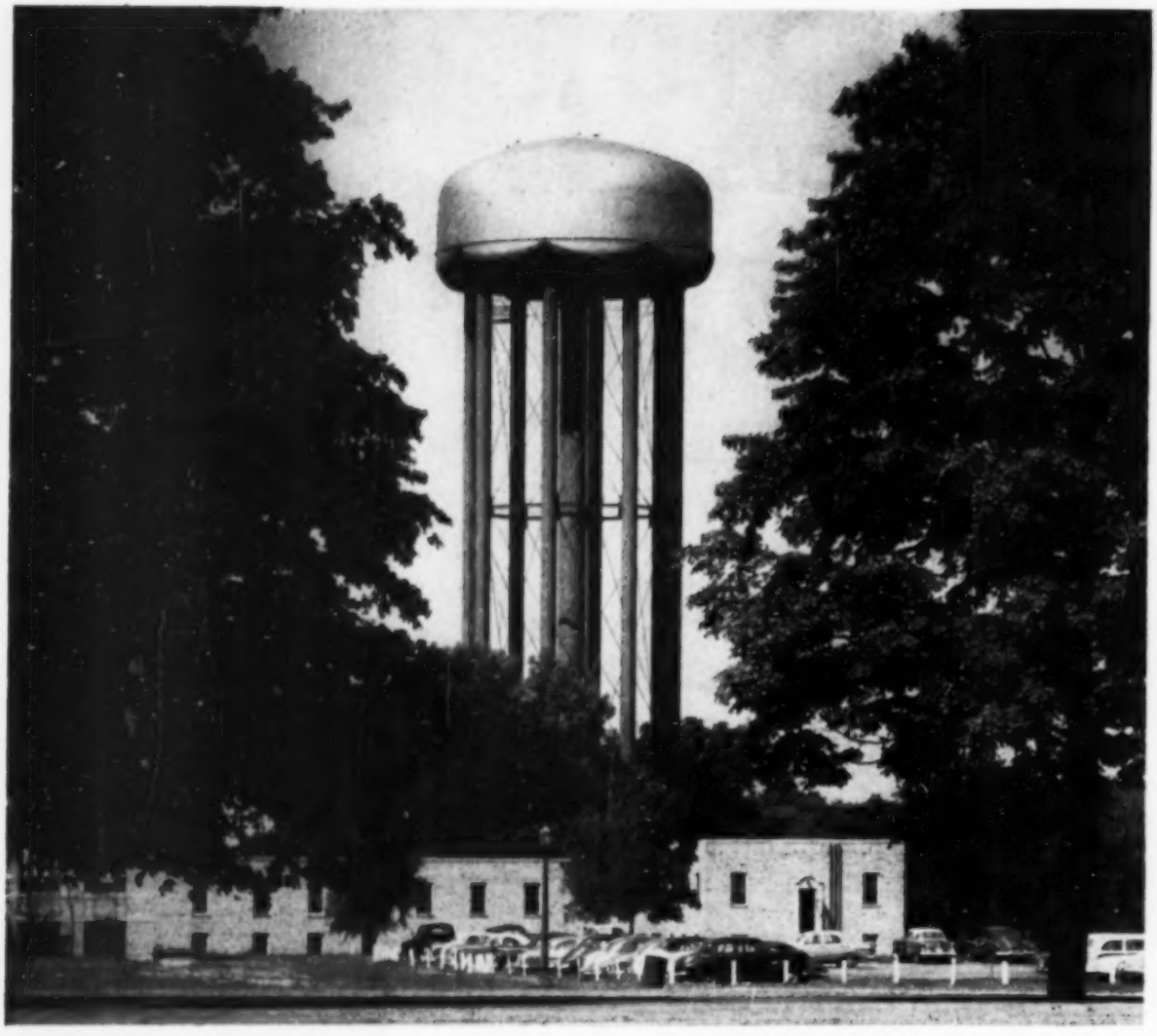

"Two Platoon" Water System Out at Notre Dame

The University of Notre Dame formerly had two separate distribution systems to supply water for domestic purposes and fire protection. With the completion of extensive improvements, the dual water system, like the "two platoon" system in football, is out.

The former arrangement of one water system for drinking and the other for general service posed a health threat because of the chance that untreated lake water in lavatory connections might be used for brushing teeth or drinking purposes.

By installing a 500,000-gallon Horton® elevated tank and increasing its use of wells, the University eliminated, the need for lake water. Some existing wells required reconditioning and additional new mains were necessary. With the new improvements the University has a water system that is simpler to operate and that provides positive sanitation, lower pumping costs, and an adequate reserve of water for peak loads and fire protection.

Horton elevated tanks with radial-cone bottoms are built in standard sizes from 500,000 to 3,000,000 gallons. Elevated tanks with ellipsoidal-bottoms are built in standard capacities from 15,000 to 500,000 gallons. Write our nearest office for information, estimates or quotations on a Horton elevated tank to improve your water system.

Above: 500,000-gallon Horton elevated tank with radial-cone bottom. Located on the campus of the University of Notre Dame at Notre Dame, Ind., it was erected to help provide a single water system for simpler operation and positive sanitation.

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Pittsburgh 19.....3210 Alcoa Bldg.
Salt Lake City 4..509 West 17th South St.
San Francisco 4.....1584—200 Bush St.
Seattle 1.....1309 Henry Bldg.
Tulsa 3.....1647 Hunt Bldg.

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Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

CAST IRON PIPE is a versatile pipe. It has age-old and outstanding service records in water, gas and sewerage fields.

Today's U. S. cast iron pipe centrifugally cast in metal molds combines the long life characteristics of the older type of pipe with all the advantages gained through the use of a modern manufacturing process and rigid quality controls.

Whether your requirements call for centrifugally cast iron pipe in sizes 2- to 24-inch, pit cast pipe in the larger sizes or fittings—all with various types of joints and in accordance with standard specifications—we are in an excellent position to meet them promptly from our five strategically located plants.

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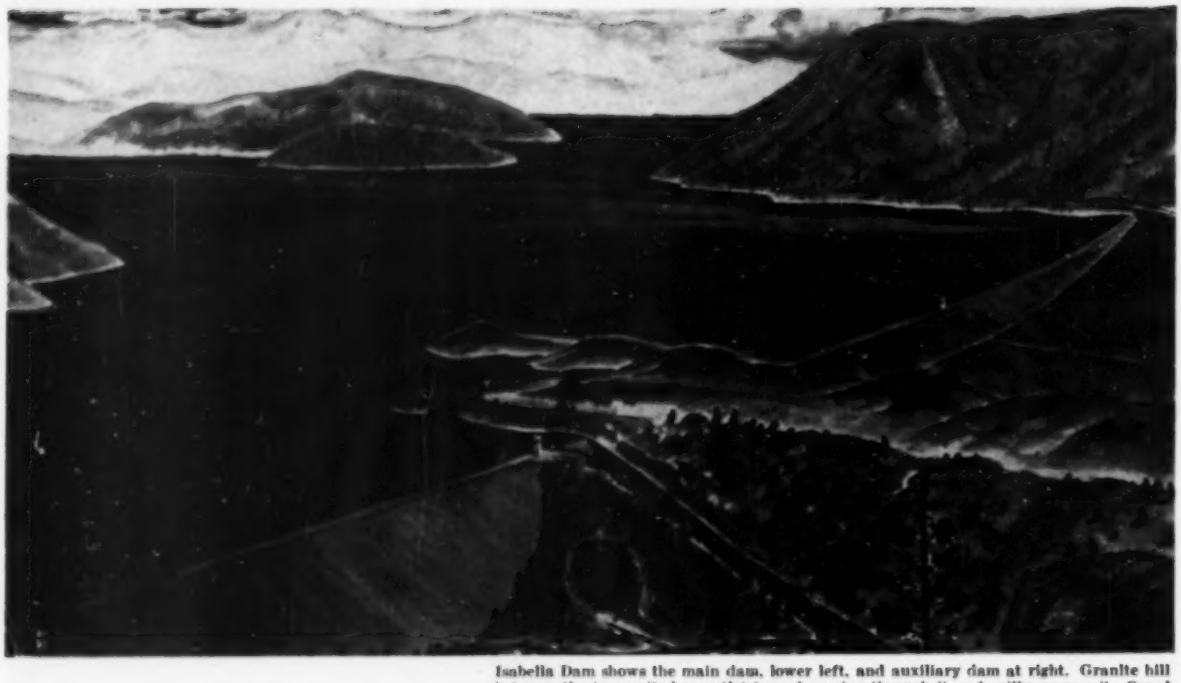

Isabella Dam shows the main dam, lower left, and auxiliary dam at right. Granite hill between the two units has outlet tunnel passing through it and spillway over it. Canal feeding from auxiliary dam supplies a power company with water to turn turbines.

2,900,000 cu. yds. of fill moved quickly on Isabella Dam

CAT® equipment and one of the largest rippers ever built team to build a dam to control the Kern River

Isabella Dam, 1,725 feet in length and 185 feet high, is ready to tame the unpredictable Kern River in California. Its completion relieves Bakersfield of the menace of floods and brings promise of greater irrigation to the lower San Joaquin Valley.

The idea was to regulate the Kern, a river of extremes. Its annual flow varies from 1,900,000 acre-feet to as little as 185,000. To do the job Isabella Dam is divided into two sections: the main dam consisting of 2,900,000 cu. yds. of fill; the auxiliary dam, 100 feet high, 3,325 feet long with 1,800,000 cu. yds. of fill. Separating the two is a hill of granite, through which has been holed the 800-foot main outlet tunnel, and over which passes the spillway.

Macco Corporation, Morrison-Knudsen Company Inc., and River Construction Corporation were awarded a $5,873,782 contract for constructing the main dam, completing the auxiliary dam, realigning a section of the canal and building a spillway. They enlisted the aid of a fleet of dependable, swift Caterpillar® machines to do the job which was designed and supervised by the Sacramento District, Corps of Engineers, U. S. Army.

The 2,900,000 yards of fill for the main dam was decomposed granite. Using Cat DW20 Tractors and matching Scrapers, the contractors hauled a daily average of 25,000 cu. yds. over a distance of 4,000 feet in two 9-hour shifts.

The material was broken up by rippers, including one of the largest rippers ever built. Aluminum irrigation pipe was laid across the broken area. The material was sprinkled for several hours, sometimes as much as 48 hours, after which it was picked up by earth-eating DW20 Tractors and Scrapers. Compaction was obtained by a 50-ton Southwest rubber-tired tamper pulled by a

CAT DW20 AND SCRAPER hauls part of the 2,900,000 cu. yds. of fill needed for the main dam. Contractors used a fleet of DW20s on the job, along with D8s, No. 12 Motor Graders and D13000 Engines. With a haul distance of 4,000 feet, the DW20s carried a daily average of 25,000 cu. yds. in two 9-hour shifts per day. Most of the fill was decomposed granite.

DW20. Working in conjunction with the tamper was another DW20 pulling an 18-foot offset disk.

Rugged Caterpillar equipment entered into every phase of the job. In all, the contractors made use of fourteen DW20s with Scrapers, three DW20s with plows and compactors, eight D8s, two No. 12 Motor Graders and D13000 Diesel Engines to power Gardner-Denver compressors.

From experience these contractors know the dollar-saving advantages of standardizing on Caterpillar equipment. Through this wise standardization, their operators and mechanics become familiar with one make of equipment. There is no need to carry a stock of parts. Many parts on Cat Engines are interchangeable—and service from your well-stocked Caterpillar Dealer is prompt.

Why not have your Caterpillar Dealer demonstrate the equipment that will do your job quicker and cheaper? Discover for yourself the reasons why the machines you see on the toughest jobs are always Caterpillar yellow.

THREE CATERPILLAR UNITS work together on the auxiliary dam. Widening and raising the fill are a DW20 pulling a 50-ton tamper, a DW20 pulling an offset disk and a third DW20 spreading fill for the job.

A CAT NO. 12 MOTOR GRADER finishes the bottom of a canal while D13000 Diesels power Gardner-Denver 500 compressors on top of bank. Graders also maintained haul roads.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

*Both Cat and Caterpillar are registered trademarks—®

THE MEMBERSHIP OF A C. I. P. Century Club

96%

OF ALL 6-INCH AND LARGER CAST IRON WATER MAINS EVER LAID IN 23 REPRESENTATIVE CITIES ARE STILL IN SERVICE.

Based on the findings of a survey conducted by leading municipal works engineers.

CAST IRON PIPE

DISTINGUISHED CLUB... now has 60 Members!

The Cast Iron Pipe Century Club is probably the most unusual club in the world. Membership is limited to municipal, or privately-owned, water and gas supply systems having cast iron mains in service for a century or more. Although the Club is formally constituted, there are no dues, no regular meetings, and no obligations other than to inform the Recording Secretary if and when the qualifying water or gas main is taken out of service, or, sold for re-use.

In spite of the unique requirement for membership, the Club roster grows, year by year, from 18 in 1947 to 60 in 1954. And why not, when a survey sponsored by three water works associations, indicates that 96% of all 6-inch and larger cast iron water mains ever laid in 25 representative cities are still in service. And when answers to a questionnaire, mailed to gas officials in 43 large cities, show that *original* cast iron mains are still in service in 29 of the cities.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.

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Mobile, Alabama
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NEW HAVEN GAS COMPANY
New Haven, Conn.
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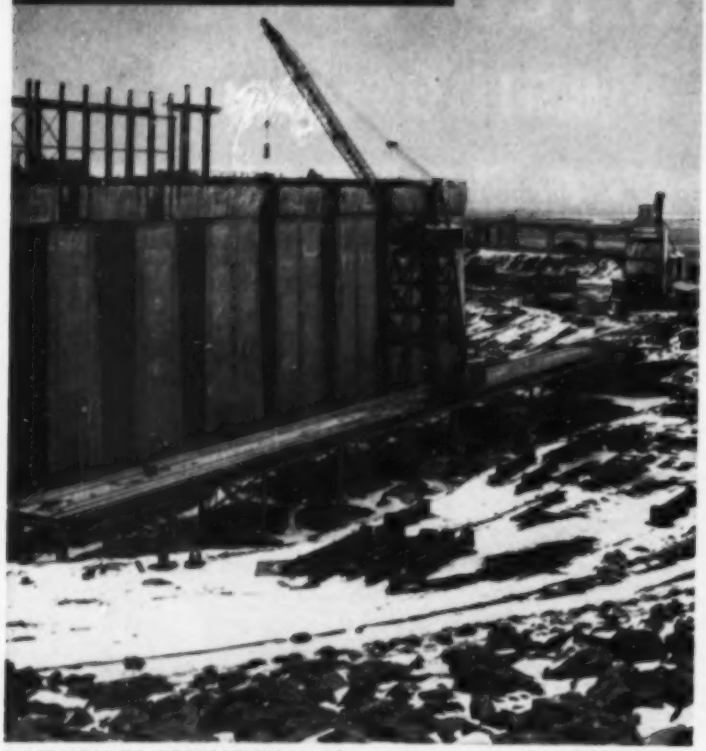
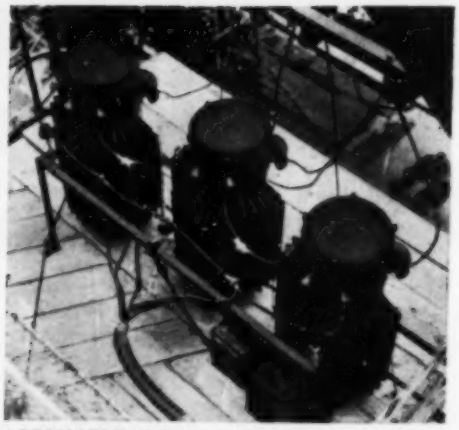
POTTSVILLE WATER COMPANY
Pottsville, Pennsylvania
PROVIDENCE GAS COMPANY
Providence, Rhode Island
QUEBEC POWER COMPANY, GAS DIVISION
Quebec, Canada
BUREAU OF WATER
Reading, Pennsylvania
DEPT. OF PUBLIC UTILITIES (gas)
Richmond, Va.
DEPT. OF PUBLIC UTILITIES (water)
Richmond, Va.
ROCHESTER GAS & ELECTRIC CORP.
Rochester, N. Y.
WATER & SEWERAGE DEPARTMENT
City of Saint John, N. B.
DEPT. OF PUBLIC UTILITIES, WATER DIVISION
St. Louis, Missouri
SALEM GAS LIGHT COMPANY
Salem, Mass.
WATER DIVISION, Dept. of Engineering
Syracuse, New York
THE CONSUMER'S GAS CO. OF TORONTO
Toronto, Ontario
DEPT. OF PUBLIC WORKS
Troy, New York
CITY OF UTICA, BOARD OF WATER SUPPLY
Utica, New York
CITY OF WHEELING WATER DEPT.
Wheeling, West Virginia
WILMINGTON WATER DEPT.
Wilmington, Delaware
WATER DEPARTMENT
City of Winchester, Virginia
WATER DEPARTMENT
City of Winston-Salem, North Carolina
YORK WATER COMPANY
York, Pennsylvania
WATER DEPARTMENT
City of Zanesville, Ohio

SERVES FOR CENTURIES

ENGINEERING REPORTS:



ELECTRICAL CO-ORDINATION provides continuous operation of this revolver crane 100 feet above the base of the huge intake structure. Movement along trestle is powered by a G-E 200-hp Type MR motor at foot of the gantry.



ADEQUATE POWER to maintain smooth, dependable crane performance is stepped down by these portable G-E transformers.

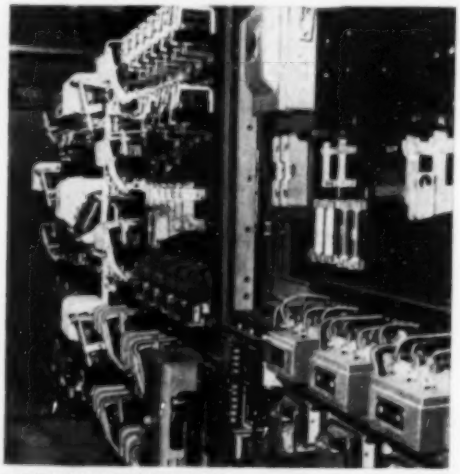
RELIABLE DRIVES must stand exacting demands of this revolver crane. G-E 200-hp motors and control are key to this application.

Electricity helps Garrison Dam keep round-the-clock schedule

G-E drives, still on the job after six years, are helping to harness Missouri River

At Garrison Dam near Bismarck, N. D., completely electrified equipment plays a vital role in keeping round-the-clock construction work on schedule. All electrical systems for the project's main stages were designed and co-ordinated by U. S. engineers, Peter Kiewit and Son Co., and Morrison-Knudsen Co. contractors—aided by G-E application engineering. This engineering teamwork resulted in maximum working capacity and fast, smooth operation.

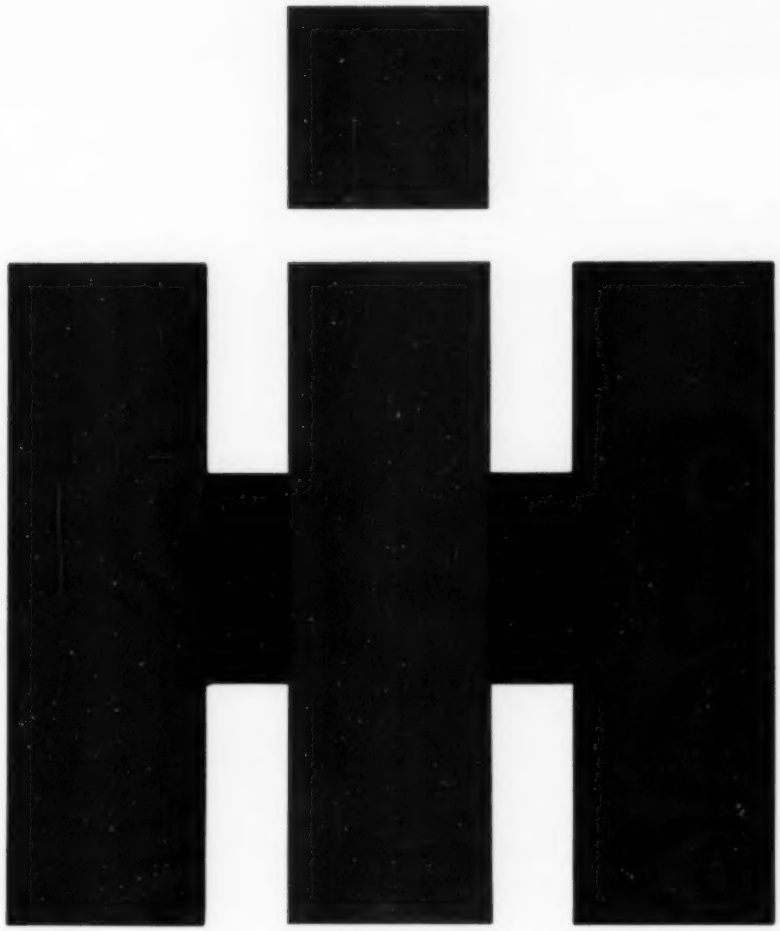
Let G-E application engineers help *you* get the most from your construction equipment through electrification—from the smallest drive to the largest power distribution system. Contact your nearest G-E Apparatus Sales Office. General Electric Co., Schenectady 5, New York. 664-31



CENTRALIZED CONTROL equipment on this compact G-E panel is mounted in the cab for simple one-man operation.

Engineered Electrical Systems for Heavy Construction

GENERAL ELECTRIC

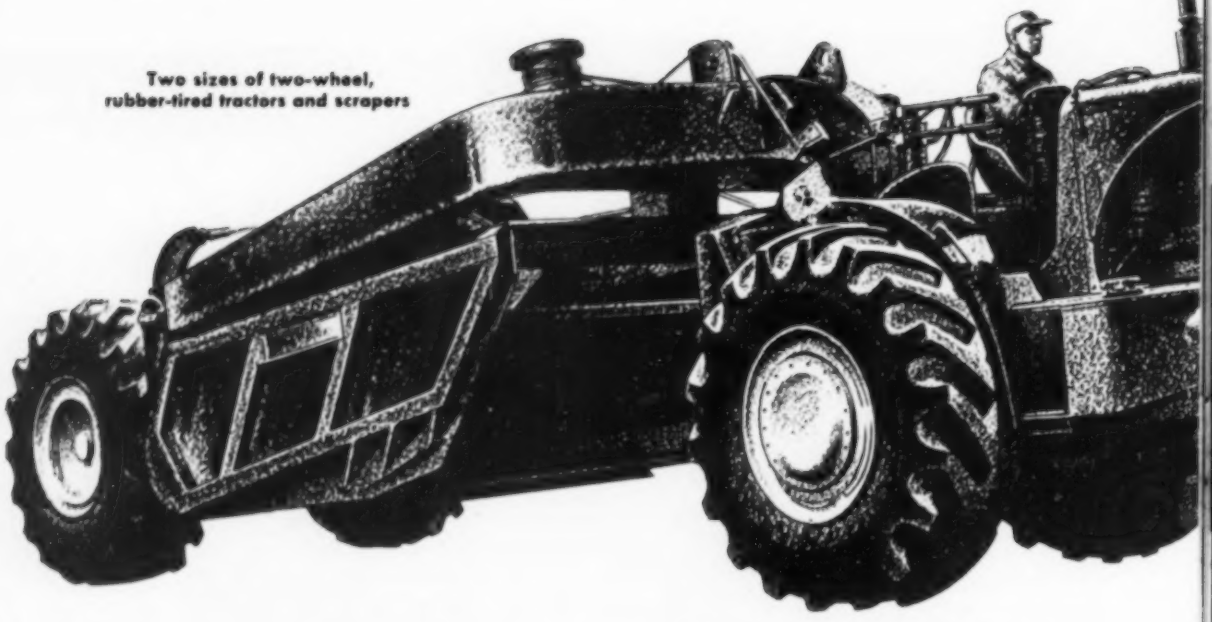


International Harvester and INTERNATIONAL Industrial Distributors present a complete line of modern earthmoving equipment, led by the INTERNATIONAL two-wheel, rubber-tired tractors with scrapers, and by "Big Red," the INTERNATIONAL TD-24, world's most powerful crawler

INTERNATIONAL HARVESTER

INTERNATIONAL

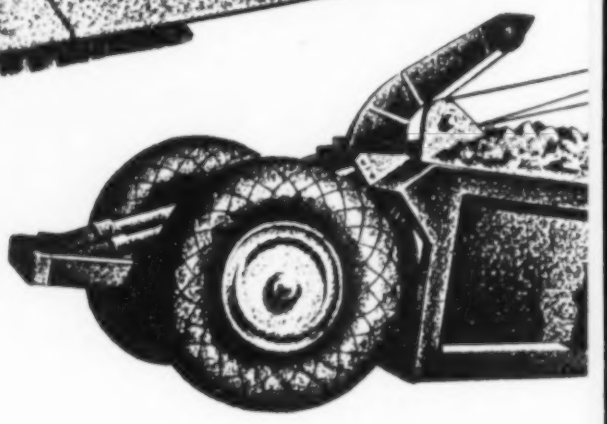
POWER TO MOVE THE EARTH



Two sizes of two-wheel, rubber-tired tractors and scrapers

Now a complete earthmoving line that comes in the

TD-24 with tilting bulldozer



Two-wheel, rubber-tired tractor with wagon

Big Red Package

Got a big job to do? Call on INTERNATIONAL'S new Big Red Team!

- Seven rugged crawlers headed by the TD-24—most powerful crawler on the market!
- Twenty-two matching hydraulic and cable-controlled bulldozers and bullgraders, with land-clearing blades available!
- Four 4-wheeled scrapers!
- Two high-speed, two-wheel, rubber-tired tractors with scrapers (13 and 18 heaped-yard capacity)!
- A high-speed, two-wheel, rubber-tired tractor with bottom dump wagon (20 heaped-yard capacity)!

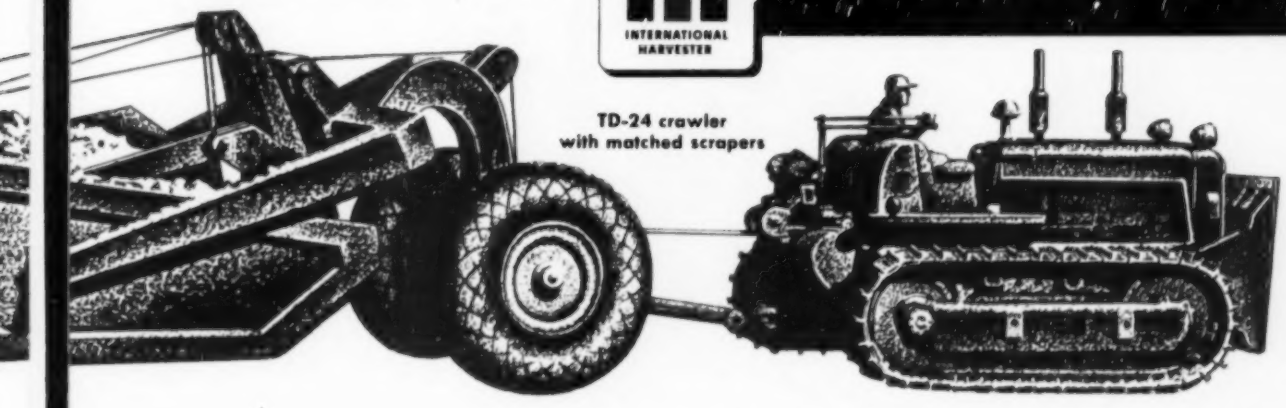
These great machines, now grouped under the INTERNATIONAL banner, have proved their dependability and economy to contractors for years on big projects around the world.

Your INTERNATIONAL Industrial Distributor has the equipment that will help you make a profit on any job you tackle. Call him for full details . . . or for actual demonstrations. See for yourself!

POWER THAT PAYS

INTERNATIONAL HARVESTER

INTERNATIONAL



TD-24 crawler with matched scrapers

Now All in One Family

the hardest-working work teams in the world!

The new INTERNATIONAL team stars not only a full line of rugged red INTERNATIONAL crawlers, complete with INTERNATIONAL scrapers and bulldozers, but also high-speed INTERNATIONAL two-wheel, rubber-tired tractors with scrapers.

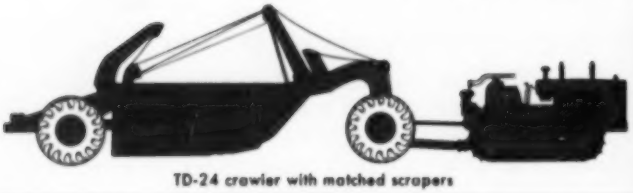
This means that now, more than ever, your INTERNATIONAL Industrial Distributor is "Earthmoving Headquarters" for your area. He offers you IH equipment to tackle any job, backed up by unsurpassed service facilities and parts supplies.

He's at your call, always, to help keep your equipment rolling . . . to cut down your down-time and pile up your profit-time . . . to serve you with INTERNATIONAL "Power that Pays!"

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL

POWER THAT PAYS



TD-24 crawler with matched scrapers

TD-18A crawler with matched scrapers

TD-24 crawler with bullgrader

TD-14A crawler with cable bullgrader

TD-9 crawler with hydraulic bulldozer

T-9 crawler with hydraulic bullgrader

TD-6 crawler with hydraulic bulldozer

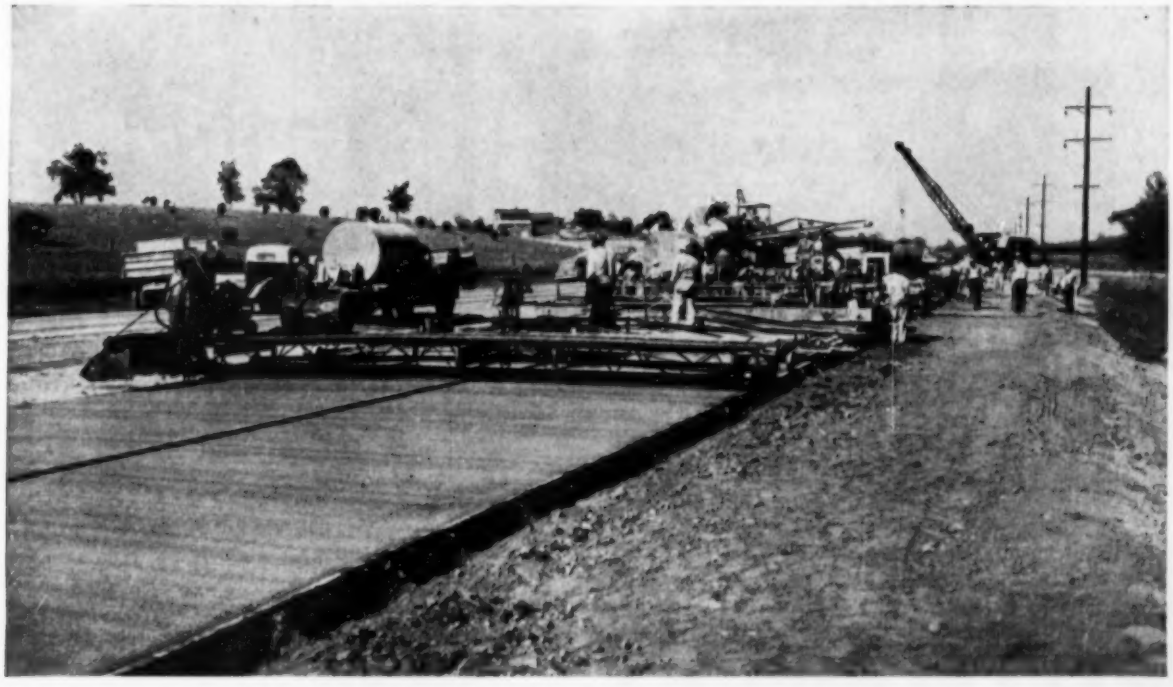
T-6 crawler with hydraulic bullgrader

Model 2T-75 two-wheel, rubber-tired tractor with 18 heaped-yard capacity scraper

Model 2T-75 two-wheel, rubber-tired tractor with 20 heaped-yard capacity bottom dump wagon

Model 2T-55 two-wheel, rubber-tired tractor with 13 heaped-yard capacity scraper

Q. Why is there less bleeding here?



A. Because the concrete's made with Duraplastic*!

A look at this picture shows one reason why so many paving contractors use Atlas Duraplastic air-entraining portland cement. Finishers can work close behind the paver because Duraplastic minimizes bleeding.

Another advantage—and an important one in the long run—is that Duraplastic cement acts to protect finished concrete from the destructive effects of freezing-thawing weather, and de-icing salts.

Contractors find that Duraplastic cement requires less mixing water for a given slump...makes a more plastic, less segregated, mix that dumps, spreads and finishes easily.

YET DURAPLASTIC COSTS NO MORE

It sells at the same price as regular cement. Complies with ASTM and Federal Specifications. For more information, write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

OFFICES: *Albany, Birmingham, Boston, Chicago, Dayton, Kansas City, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Waco.*

**"Duraplastic" is the registered trade mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.*

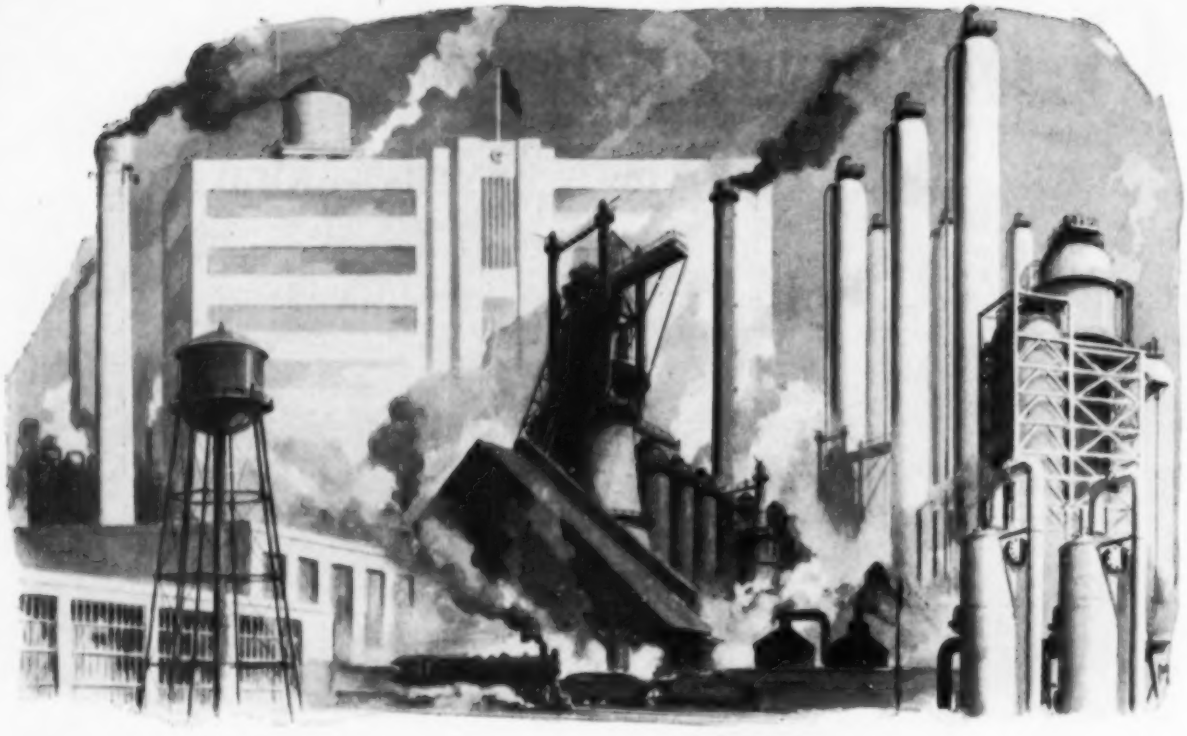
ATLAS® **DURAPLASTIC**

AIR-ENTRAINING PORTLAND CEMENT

CE-D-154

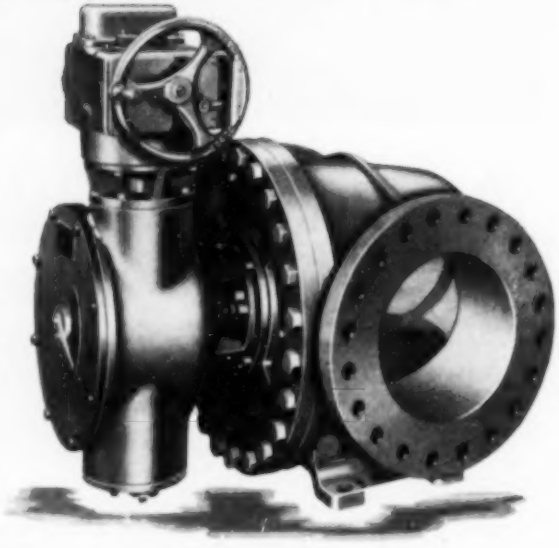
Makes Better Concrete at No Extra Cost

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.



INDUSTRY *and the*
ROTOVALVE

MARCHING toward new goals—in a mechanized manufacturing world — industrialists, engineers, plant managers and management of all kinds are exploring every means of cutting costs and increasing efficiency. This explains the great demand and use of Rotovalves. Their design permits the conical plug to lift, rotate and seat itself, and assures free flow through a full circular opening in both valve body and plug, thereby cutting losses.



Available with either manual, hydraulic or motor control, and in all sizes to fit any industry! *Shipment from stock.* Send for complete data.

S. MORGAN SMITH Co.
YORK, PENNA. U.S.A.

PLASTIMENT*
CONCRETE DENSIFIER

CONTROLS SET AND REDUCES WATER CONTENT WITHOUT INCREASING AIR CONTENT FOR

- **GREATER UNIFORMITY**
- **CRACK RESISTANCE**
- **WATER-TIGHTNESS**
- **SURFACE HARDNESS**

*Plastiment consistently produces higher structural values in concrete because it limits and controls the growth of water-consuming cement gels during mixing and placing of concrete. This action reduces the water-cement ratio and retards the set of **all** concretes, plain or air-entrained, regardless of type of cement or aggregate. Uniformity of set and water content (the governing factors of uniform concrete quality) are made possible by changing Plastiment proportions with concrete-placing-temperatures and field conditions.

Controlled set and uniformly low water content — exclusive with Plastiment — means less segregation, shrinkage, cold joints and other defects, greater uniformity and resistance to abrasion, cracking and leakage.

Write for your copy of "Plastiment, Concrete Densifier." For specific information on how Plastiment can benefit your own concrete projects, check with our engineering staff today.

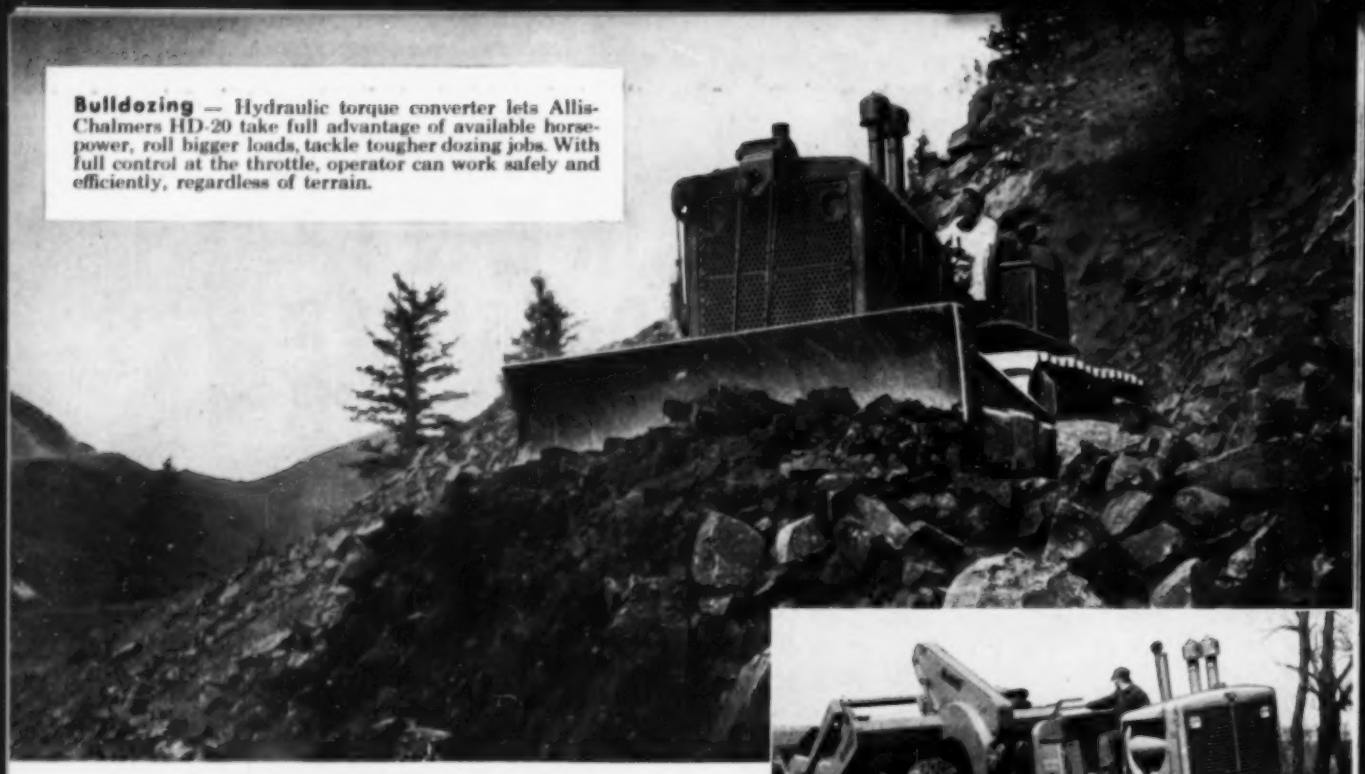
SIKA CHEMICAL CORPORATION

PASSAIC, NEW JERSEY

BRANCH OFFICES: PITTSBURGH, SALT LAKE CITY, MONTREAL, PANAMA, CHICAGO • DEALERS IN PRINCIPAL CITIES

Field installations and laboratory tests prove Plastiment's beneficial influence on uniformity, impermeability and resistance to cracking and abrasion.

Plastiment-concrete has been used in many of the world's outstanding projects — floating concrete drydocks, U. S. Navy — concrete ships and barges, U. S. Maritime Commission — Pier 57, New York — the world's largest prestressed concrete bridges and tanks — Metropolitan housing projects, Los Angeles and San Francisco — Gateway Center Buildings, Pittsburgh — and many others.



Bulldozing — Hydraulic torque converter lets Allis-Chalmers HD-20 take full advantage of available horsepower, roll bigger loads, tackle tougher dozing jobs. With full control at the throttle, operator can work safely and efficiently, regardless of terrain.

AN ALLIS-CHALMERS REPORT

How hydraulic torque converter drive improves big tractor performance—increases job output

With a two-range transmission and hydraulic torque converter, the Allis-Chalmers HD-20 is the only crawler tractor that is capable of exerting maximum drawbar pull *at all times* . . . under all load and terrain conditions . . . without gear-shift guesswork.

Whatever the job, the operator need merely make contact with the load and then open the throttle. As the load requirements change, the hydraulic torque converter *automatically* matches the conditions with exactly the right combination of speed and pull.

This eliminates most shifting . . . leads to far more work done in a continuous work cycle . . . far longer equipment life.

• • •

Hydraulic torque converter drive, exclusive as standard equipment with Allis-Chalmers, is just one of many reasons why the HD-20 assures you higher output with less upkeep. Your nearby Allis-Chalmers dealer invites you to get the full story . . . and to see it in action.

WEIGHT — 41,000 LB. • 175 NET HP. AT FLYWHEEL

ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

Pulling — Hydraulic torque converter drive actually multiplies torque up to four and one-half times . . . develops tremendous drawbar pull to start the load smoothly . . . and automatically accelerates to the highest speed that conditions permit, in either high or low range.

Pushing — Operator just makes contact, then opens the throttle and relaxes. The HD-20 automatically matches speed to that of pushed equipment, maintains steady contact while loading, sends load off to the fill at higher speed.

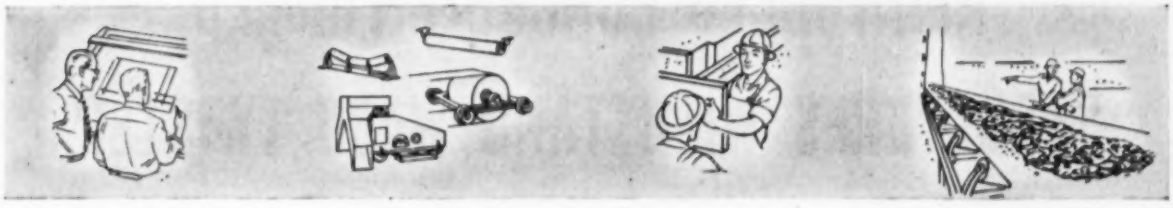
Digging and Loading — With the HD-20G, the operator crowds surely and steadily, using only throttle and bucket levers. With full horsepower always available even at creeping speed, he can work effectively in mud, on hillsides or edges of banks.

BEAT HIGH TRANSPORTATION COSTS--

carry the load via belt conveyors

Exemplifying "total engineering", this Link-Belt roller bearing belt conveyor system moves earth over more than a mile of rugged terrain, from borrow pit to dam construction site.

LINK-BELT offers you the "total engineering" so necessary for top efficiency



DESIGNED FOR OVERALL EFFICIENCY

Because of its unrivalled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit conveyors into your system requirements.

BUILT FOR LONG-LIFE PERFORMANCE

Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the job.

DELIVERS FULL RATED CAPACITY

Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews.

ASSURES SATISFACTORY PERFORMANCE

When you rely on Link-Belt as a single source for your complete system, Link-Belt accepts responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems.

Next time you're in the market for one belt conveyor or a complete system, call a conveying expert in the Link-Belt office near you. It's his job to help you get the best in belt conveying at the lowest possible overall cost.

LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13.360-C

ROOSEVELT HOTEL STANDS ALONE AMIDST WRECKAGE. Although located in the heart of the tornado's path, The Roosevelt Hotel stands unyieldingly in a block that was *more than 50% destroyed* by the rampaging winds. Engineers reported "no structural damage" to this 12-story reinforced concrete frame building.

REINFORCED CONCRETE FRAMED STRUCTURES WITHSTAND WACO TWISTER

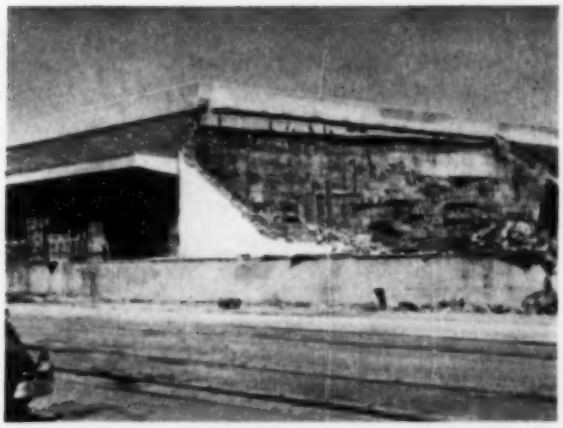
ON the afternoon of May 11, a tornado struck Waco, Texas, with devastating effect. 115 Lives were lost, property damage ran into several million dollars, and some blocks in the downtown area in the twister's heart were *over 80% destroyed!*

The tornado's fury was concentrated in an area of a few blocks. Many of the buildings in this area were completely demolished. Among them were the 5-story building of R. T. Dennis Co., the Joy Theatre, Neely Paint Co., Pollock Paper Corporation, and many smaller structures. Heavy brick parapet walls along the street side blew off and crashed into the street. Occupants were trapped in the cave-in. Cars in the street were crushed by falling brick!

But despite this general pattern of destruction, investigating engineers found that reinforced concrete framed structures suffered only superficial damage! While adjacent brick buildings were demolished, all reinforced concrete framed structures remained substantially intact—standing alone amidst the surrounding destruction.

DEBRIS IS ALL THAT REMAINS OF 5-STORY R. T. DENNIS BUILDING. This and four other buildings in the immediate area were obliterated by the storm. The buildings in the rear both have a reinforced concrete frame.

FRONT VIEW OF BUILDINGS IN 400 BLOCK ON FRANKLIN STREET shows the terrible toll the tornado took of buildings whose frame construction was less rigid than reinforced concrete. This is typical of the fate of the load-bearing wall-type of structures in the twister's path!



DRAMATIC ILLUSTRATION OF THE ABILITY OF REINFORCED CONCRETE TO WITHSTAND THE TWISTER is the Waples Platter Co. building. At right is all that remains of the brick portion of warehouse, but reinforced concrete section, left, is structurally unaffected by the storm.

Texas tornado traces path of ruin... reinforced concrete structures still stand!

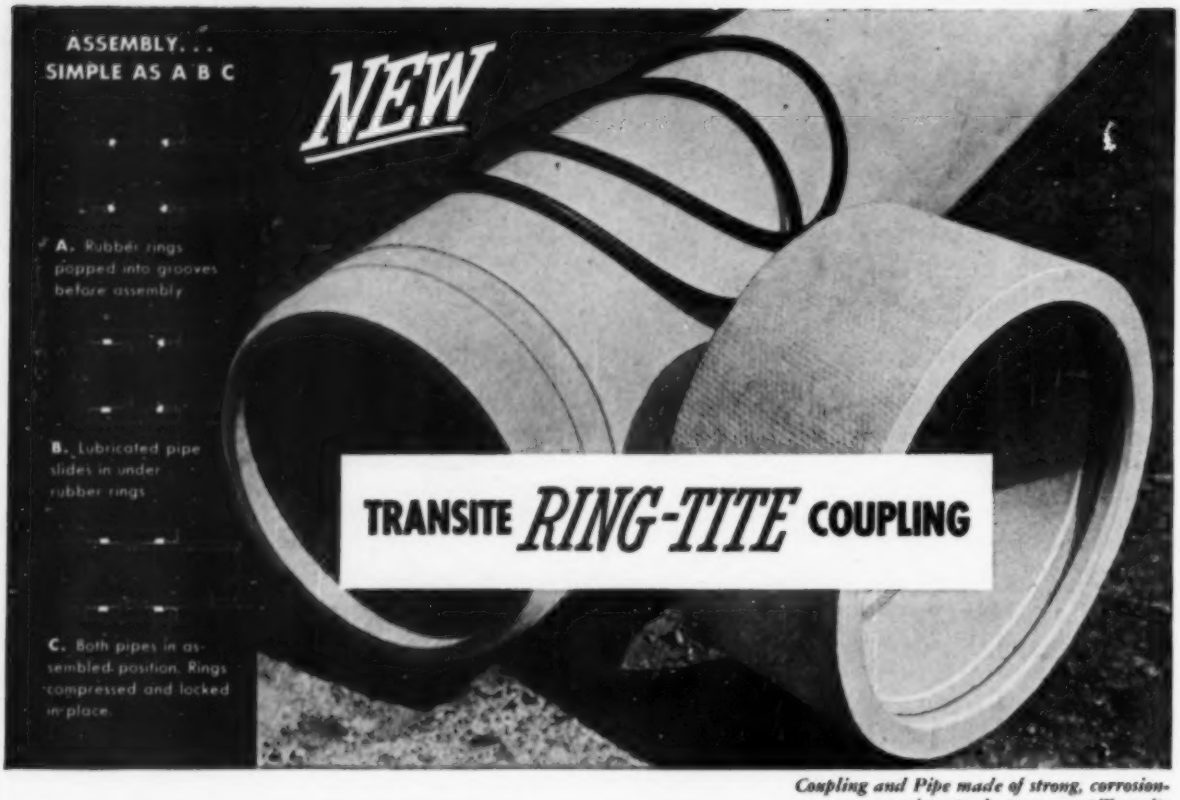
What an attempt to "economize" with structural frames less rigid than reinforced concrete meant in loss of life and property in Waco is obvious from photographs of the tragedy. In the large, these buildings were leveled!

In contrast, here is the engineering report on reinforced concrete framed buildings in the storm's center: Roosevelt Hotel—12-story r/c frame bldg., no structural damage; Behrens Drug Co.—4-story r/c frame bldg., no structural damage; Southwestern Drug Corp.—4-story r/c frame bldg., no structural damage; Professional Bldg.—10-story r/c frame bldg., no structural damage; Frank Latham Co.—r/c frame bldg., no structural damage; Southwest Coffee and Spice, Ltd.—2-story r/c section, no structural damage; Youngblood's General Office Bldg.—no structural damage to r/c section; Waples Platter Co.—1-story bldg., no structural damage to r/c section; City Hall—r/c bldg., no structural damage; Allen Miller—partially r/c bldg., no damage to r/c columns and beams.

If *all* of the downtown Waco buildings had been of reinforced concrete . . . how changed the picture would have been!

CONCRETE REINFORCING STEEL INSTITUTE
38 South Dearborn Street
Chicago 3, Illinois

THESE REINFORCED CONCRETE BUILDINGS SUFFERED NO STRUCTURAL DAMAGE Behrens Drug Co. Bldg., Southwest Coffee & Spice Bldg., and Professional Bldg. (left to right) successfully rode out the storm!


ASSEMBLY. . .
SIMPLE AS A B C
NEW
A. Rubber rings popped into grooves before assembly
B. Lubricated pipe slides in under rubber rings
C. Both pipes in assembled position. Rings compressed and locked in place
TRANSITE RING-TITE COUPLING

Coupling and Pipe made of strong, corrosion-resistant asbestos-cement Transite

Cuts installation costs through fast assembly—insures locked-in tightness

Pipeline assembly can be made easy, fast and practically foolproof with the Johns-Manville Transite® Ring-Tite® Coupling. This is the new asbestos-cement coupling for Transite Pressure Pipe that gives every joint locked-in tightness.

Record savings achieved

The Ring-Tite Coupling is effecting installation savings every place it is used. Every step of the way, its special advantages and automatic features pay off.

To begin with, pipes need only rough alignment. The design of the coupling does the rest with automatic centering, automatic aligning and automatic adjusting for expansion. Rings are simply popped into grooves and pipes pulled together.

Pipe ends are automatically separated within the coupling. This provides for expansion and flexibility . . . permits line to conform to curves . . . to withstand shock and vibration . . . to relieve line stresses.

With the Transite Ring-Tite Coupling, no complicated equipment is required. Installations can be successfully completed under adverse weather, temperature or terrain conditions. And the Ring-Tite Coupling is listed by Underwriters' Laboratories, Inc.

Savings at fittings, valves and hydrants, too

The Ring-Tite Coupling saves money and time by joining pipe directly to fittings, valves and hydrants embodying the Ring-Tite design.

A TYPICAL PERFORMANCE REPORT— On the Florida installation illustrated in the photograph, a rate of progress as high as 640 feet an hour was achieved—exceeding by far the speed anticipated considering the job conditions.

For further information write to Johns-Manville, Box 60, New York 16, N. Y.

Johns-Manville TRANSITE PRESSURE PIPE

Wellpoints "Blow-Proof" A Sewer Trench

This twin 90″ storm sewer is shown under construction in Paducah, Kentucky, by the D. W. Falls Construction Co.

Material to subgrade was stiff red clay – 13′ of it – while at subgrade was a layer of sand *under artesian pressure.*

A Moretrench Wellpoint System, installed through the clay into the sand, (1) lowered the water level, (2) relieved the hydraulic uplift pressure, (3) prevented hazardous "blows". Pipe laying proceeded in absolute safety in a stable, dry trench.

Find out from our nearest office how little it costs, how much you gain, when you work with Moretrench "in the dry".

MORETRENCH CORPORATION

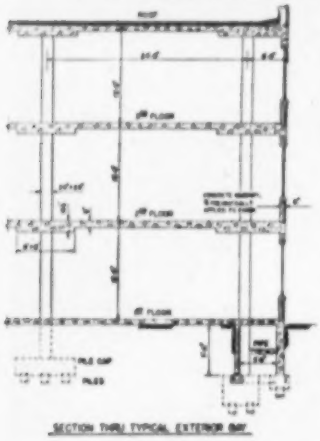
90 West St. New York 6 | 4900 S. Austin Ave. Chicago 38, Illinois | 7701 Interbay Blvd. Tampa 9, Florida | 315 W. 25th St. Houston 8, Texas | Rockaway New Jersey

Western Representative: Andrews Machinery of Washington, Inc., Seattle 4, Washington

Canadian Representative: Geo. W. CROTHERS Limited, Toronto, Ontario

HOME OF THE Army Dollar

Economy-Minded Army Planning Cuts Cost by $4-Million on 14-Acre, All-Concrete Structure, with 1¼-Million sq. ft. of Usable Floor Space

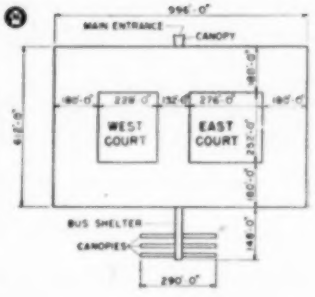


SECTION THRU TYPICAL EXTERIOR BAY

● New Finance Center at Fort Benjamin Harrison, near Indianapolis, second largest all-concrete administrative structure in the world, dwarfed only by the Pentagon, now houses Army Finance Operations, formerly scattered throughout the U. S.

Utilizing streamlined concreting methods, the 3-story, flat-slab, reinforced-concrete structure, with 1¼-million sq. ft. of usable floor space, was completed ahead of schedule, in spite of strikes, cyclone and blizzard. A total of 83,000 cu. yds. of concrete, pumped to all points within the 14-acre building area, was placed at a yard-a-minute pace.

Here is functional design, enduringly expressed in concrete, for utmost stability, durability, fire-safety and lowest annual cost—quality concrete, every yard of it, made with over 100,000 barrels of Lone Star Cement.



PLAN VIEW

FINANCE CENTER, U. S. ARMY:
Fort Benjamin Harrison, Indianapolis
E. J. BEAN, Brig. Gen., U.S.A., Commanding
Supervision: **U. S. ARMY CORPS OF ENGINEERS**, Chicago
Architects-Engineers: **HARLEY, ELLINGTON & DAY**, Inc., Detroit
Ready-Mix Lone Star Concrete—Joint Venture:
READY MIXED CONCRETE CORP. • **HESTON CONCRETE CO.**
CARLSEN CONCRETE SUPPLY, all of Indianapolis
Masonry Units: **SPICKELMIER COMPANY**, Indianapolis

General Contractors—Joint Venture:
SHERRY-RICHARDS CO., Chicago
C. E. YOUNGDAHL & CO., Inc., Long Island City, N. Y.
CORBETTA CONSTRUCTION CO., New York
JAMES McHUGH CONSTRUCTION CO., Chicago
Contractor for Water Supply, Sewers, Railroad Siding:
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JANUARY 1954

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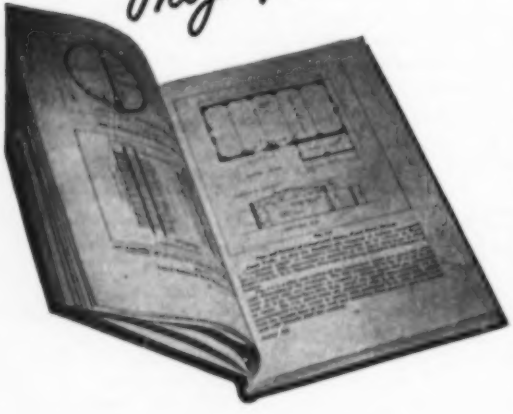

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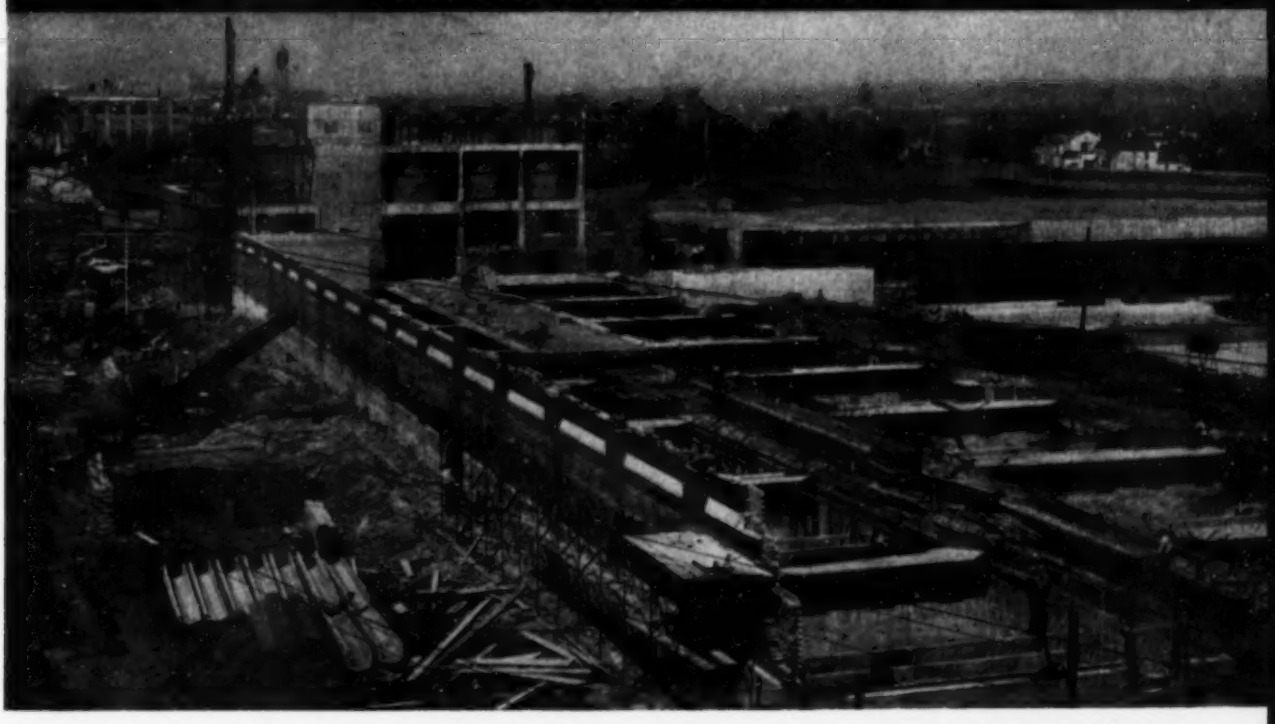


Water purification and softening plant was constructed at cost of $4,250,000. Financing was by general-obligation bonds to be retired from regular water revenues. Long structure in foreground will house two rows of indoor filters—16 in all. At right are outdoor mixing and settling basins. Chemical building at far end also houses administrative offices and laboratories.

Dayton's water treatment plant pays its own way

LOYD C. HUFFMAN

Director of Water

City of Dayton

Ohio

Dedication of the new Water Purification and Softening Plant in the summer of 1953 marked an event of special importance to the City of Dayton, (Fig. 1). The new plant's $4,250,000 price tag marked it as the most costly single project yet undertaken by the municipal government of this city of 259,000 people. It was financed by bonds to be retired from regular water revenues.

Dayton is one of the largest cities in this country to get its water supply exclusively from wells. Pumpage during 1952 averaged 43 mgd, with a peak of 62 million gallons pumped during one 24-hour period.

As a preliminary to construction of the new water purification and softening plant, the Dayton Department of Water in 1951 laid $1^1/_2$ miles of 72-in. reinforced concrete pressure pipe conduit as an additional raw-water line. This provided another link between the city's well field (concentrated on an island in the river four miles above the waterworks) and the terminus of an 84-in. reinforced-concrete pressure-pipe conduit that had been installed in 1927 to serve the pumping plant.

Water storage and pressure facilities also have been expanded in the last few years. These include two new 2,000,000-gal elevated storage tanks and a 16,000,000-gal underground hilltop reservoir located in outlying sections of the city, as well as an additional 5,000,000-gal suction reservoir at the pumping station and treatment plant, making two of these reservoirs there.

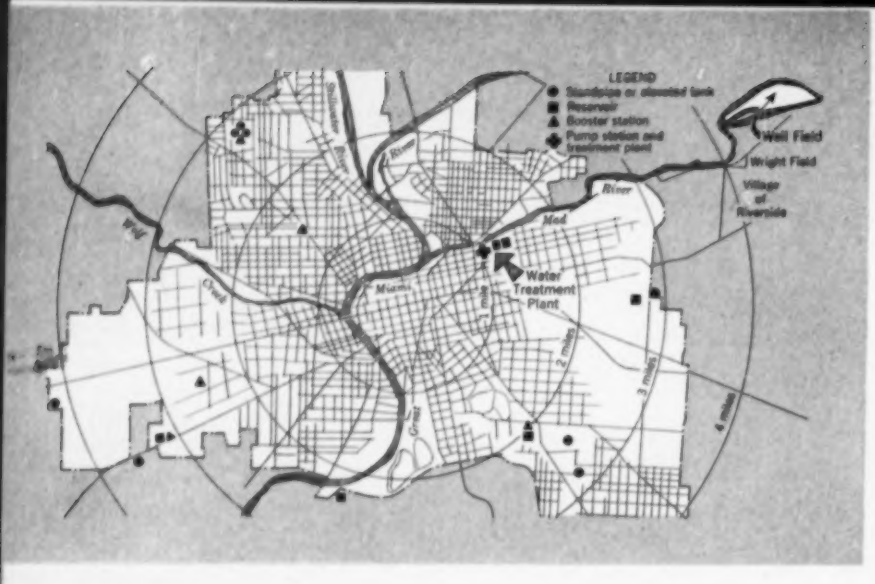


FIG. 1. Sketch map shows general location of Dayton's new water purification and softening plant and appurtenant facilities with relation to city and main watercourses.

At the end of 1952 the city was operating 41 modern, individually pumped wells with a combined capacity of 104 mgd. This supply was in addition to a conservative 5 mgd available from a group of older wells collectively pumped at a location nearer the waterworks. Dayton's newer wells range from 12 to 28 in. in diameter and are from 59 to 169 ft deep. Four additional deep wells were completed in 1953 to increase the raw-water capacity to 123 mgd. The city entered the year 1953 with 65,672 water customers who were served through 512 miles of mains. Pumping motors aggregated 9,050 hp.

Pioneers found ample water supply

The pioneers who settled Dayton in 1796 obtained their water from the abundant springs and the then unpolluted streams. The community was situated at the confluence of the Great Miami, the Mad, and the Still-water rivers and the sizeable Wolf Creek. Some early settlers proposed calling the place Venice, but it retained the name of one of the early land developers, Jonathan Dayton, a general in the Revolutionary War.

As the community grew, its residents found ample water by merely sinking wells almost any place in the vicinity. But Dayton's well water was hard—22 grains—and many householders maintained cisterns in which to store rainwater as a soft water supply. The city, too, built cisterns under principal street intersections to store water for fire-fighting purposes. This supply however proved inadequate. In the 1860's Dayton was struck by several disastrous fires made serious by lack of sufficient water. This gave impetus to public interest in a regular municipal waterworks.

On April 5, 1869, the people voted for a public water supply system for this community which then had a population of 31,000. Digging of a well 25 ft in diameter and 15 ft deep was started immediately, and in August a contract was signed for two Holly patented elliptical rotary pumps.

The first water was pumped through the system on March 16, 1870. The official test of this system, on March 31 of that year, was the first of its kind in the western states. The test consisted of two lines of fire hose, each 1,000 ft long, throwing streams of water across a wire stretched 100 ft above the principal street intersection. The citizens were both pleased and amazed, and a newspaper of the day reported that it was "one of the most notable events which have transpired here."

By the end of 1870 the city possessed 16 miles of water mains and had pumped during the ten-month period a total of 92,580,000 gal of water (enough today for only a two-day supply) to 462 services. That well soon proved inadequate and for two months in the summer of 1874 water was pumped from the nearby Mad River directly into the distribution system.

In 1877 the city drove thirty 8-in. wells to a depth of 40 ft in the Mad River bottom near the central pumping station. By 1901 there were 94 of these 8-in. wells linked directly to the suction of the station's pumps. The city's population then was 85,300, and the daily pumpage of 6,835,000 gal was distributed through 129 miles of mains.

In 1908 it became obvious that the wells in the Mad River bottom close to the pumping station were inadequate to provide the city's sole water supply. The wells averaged only a little more than 10,000 sq ft of land area each. Water shortages had been periodic since the system was first operated.

In seeking a solution to the problem of finding a better water supply, test wells were driven in the valleys of the Great Miami River, the Mad River, and Wolf Creek. The results of a survey of the Great Miami River by the U. S. Geological Survey were also studied. This river at Dayton has a total watershed of 1,811 sq miles, a fall of 320 ft, and a length of 56 miles. A large percentage of the area is quite rolling, carrying a rapid runoff from rainfall.

Old photograph shows steam-operated crane laying 84-in. precast reinforced concrete raw-water conduit in 1926, using trammel joints. This pipe has been found in perfect condition except for some seepage through softened joints. Both 1926 and 1951 pipe was supplied by same firm, Price Brothers Co. of Dayton.

Crane places section of 72-in. reinforced concrete raw-water conduit leading from well field to treatment plant. Rubber and steel joints are believed to prevent leakage. In this work, done in 1951–1952, 10-ft excavation was in gravel only a few hundred feet from Mad River so that seepage had to be pumped continuously.

The smaller Mad River at Dayton has a total watershed of 640 sq miles, a fall of 470 ft, and a distance to its headwaters of 58 miles. The Mad River Valley includes considerable prairie land which is low and swampy, much of it being so low that it can be drained for farm use only with difficulty. Consequently, the Mad River Valley was chosen as the location for future wells in the Dayton water system.

Despite the presence of the three rivers and the sizable creek, it was a good decision not to utilize the surface waters. The largest of the rivers has a minimum flow of only 78 mdg, precariously close to the peak amount pumped in 1952.

With the decision to continue to depend on the Mad River Valley as the principal water source, the city during the 1910's began drilling wells $2^1/_2$ miles upstream from the pumping station. By 1914 a total of twenty-eight 8-in. wells had been completed, with a 36-in. raw-water line connecting them to the pumping station. In 1921 a group of 11 more wells was developed still further upstream.

Expansion of Dayton to the higher suburban areas surrounding the original city following World War I required the installation of a separate high-pressure water storage and distribution system, in addition to the low-pressure system serving the lower elevations. A 1924 survey by the Boston engineering firm of Metcalf and Eddy resulted in the electrification of the previously steam-powered pumping station. It also resulted in construction of a 5,000,000-gal underground suction reservoir at the pumping station and the laying of $2^1/_2$ miles of 84-in. and $1^1/_2$ miles of 54-in. precast concrete pressure pipe as a raw-water conduit from the well field to the pumping station. The older 36-in. line which the new 84-in. line replaced was left intact as an alternate emergency facility.

In 1926 the city changed its policy and began developing larger wells, individually pumped. On December 1 of that year the City Commission established the separate Department of Water, which previously had been a division in the Department of Services. Considerable interest in a municipal water filtration plant developed after the water system underwent the major renovation and modernization of the 1920's.

Well locations advantageous

One particular advantage of the present concentration of wells on a low-lying island is the ease with which they can be recharged by flooding the well field with river water. Approximately 35,000,000 gal of Mad River water was turned into the flooding basin during 1952 for a relatively quick movement through the surface gravel to underground storage. This easy replenishment of well water, however, made health authorities apprehensive lest the supply become contaminated at the source from inadequate filtration through the gravel. The Ohio Department of Public Health for several years had been urging the construction of a modern filtration plant. At that time chlorination was the sole method of purification.

Knowledge gained in the meantime had indicated that the potentialities of Dayton's subsurface water supply are enormous. This is because a preglacial river valley underlies part of the present Great Miami and Mad River valleys to a depth of 100 to 300 ft. This deep water storage area is known to geologists as the "Hamilton River." Several glaciers which extended this far south in Ohio, in various prehistoric periods, left deposits of gravel in the very wide and deep original river channel. Dayton's municipal wells thus far have tapped strata of these water-bearing gravels. The lower strata show an increasingly higher iron content and a lower permanent hardness content in the water. These features are an advantage in softening a public water supply.

The first serious proposal for a water purification and softening plant finally was put forward in 1945 as part of a major program of community improvements. The program in general won public acceptance, but rising costs following World War II discouraged early construction. However, a Citizens' Water Advisory Committee, named by the City Commission to study the matter, reported on September 27, 1950, that such a project was needed and that the city should proceed immediately. The new plant, according to the committee, should be adequate to meet Dayton's water requirements for at least another generation—calculated at 96 mgd.

General-obligation bonds issued in 1951, and later assumed by the water department, provided the funds for the engineering and construction work. The engineering firm of Alvord, Burdick and Howson of Chicago was engaged to provide plans

Elbow in 84-in. precast pipe is being installed as part of effluent line carrying treated water from filtration and softening plant to one of two 5-million-gal suction reservoirs close to plant. For high-pressure system two 2,000,000-gal storage tanks and one 16,000,000-gal hilltop underground reservoir have recently been provided in outlying areas.

In 1951 new line was laid generally parallel to old one to bring increased supply from well field. Here section of new 72-in. reinforced concrete steel cylinder pipe is being extended under 84 × 72-in. cast-in-place reducer laid in 1926. Stack in foreground is 20-ft riser.

and construction supervision. Construction contracts were awarded as follows: to the S. N. Nielsen Co. of Chicago, the general contract for structures and outside piping, $3,011,690; to the Bass Engineering and Construction Co. of Birmingham, Mich., for filter equipment, $742,846; to the Dorr Company, of Stamford, Conn., for mixing and settling equipment, $172,687; to the Chicago Bridge and Iron Co. of Chicago, for steel chemical bins and wash tanks, $91,800; and to the Brady Conveyors Corp. of Chicago, for the pneumatic conveyor, $25,739.

Ground was broken on May 15, 1951, and the operating plant was formally dedicated on May 27, 1953. A force of 22 men operate the plant 24 hours per day in such a way as to insure the water's purity and also reduce the original 22-grain hardness to between 6 and 8 grains. Tests are now being made to determine the plant's most efficient operating level.

After the improvements of the 1920's, the raw water from the well fields four miles away was brought part way by a 54-in. concrete pressure pipeline and the rest of the way by an 84-in. line of similar construction. In 1951 approximately $1^1/_2$ miles of the latest type of reinforced concrete steel cylinder pipe, ranging in diameter from 48 to 72 in., was laid generally parallel to the old 54-in. line, which was no longer adequate for the growing community. Approximately half of the new installation consists of 72-in. pipe. Both the 1926 pipe and the 1951 pipe were supplied by the Price Brothers Co. of Dayton.

The decision to continue with reinforced concrete pressure pipe was made on the basis of the highly satisfactory experience with the earlier pipe. The original pipe sections had given the city no trouble; the flow coefficient had increased over the years; and the pipe concrete had hardened to a point noticeably beyond that shown by the original tests.

The only problem encountered with the original pipe laid in the 1920's has been a small amount of seepage through softened spots in the trammel joint material between some pipe sections. The material used in this joint was a sulphur compound. Uncovering the pipe to repair a seeping joint always has revealed that the pipe itself is in perfect condition.

New steel and rubber joint

The answer to the joint leakage is believed to be the new rubber and steel flexible joint used in the line laid in 1951 and in other lines laid subsequently. Long-lasting, watertight connections are believed assured by the use of this flexible joint made of rubber and zinc-coated steel. The steel eventually takes the back load and the rubber gasket forms the seal.

Construction of the 72-in. line in 1951 was without incident. The line was laid in a straight and uniform 10-ft excavation made by pans. Seepage from the river nearby was pumped continously since much of the excavation was in gravel only a few hundred feet from the Mad River, where the water table was high. The pipe sections were placed with a crane.

Feeder wells were tied into the new line at connections fabricated into the 16-ft sections of pipe. The link with the 84-in. conduit was made through a terminal connection chamber that had been installed in 1926. The Water Department of those days had anticipated this connection 25 years before by providing a poured concrete plug. When this plug was removed, the new connection was easily made.

The raw-water lines were installed to provide for gravity flow from the well fields to the waterworks plant. Construction of the water purification and softening plant, however, raised the level of the new terminus so as to provide for a pressure head of 6 to 8 lb.

Construction of the new plant required the laying of nearly 1,200 ft of 72-in. pressure pipe of the same type to serve as a bypass around the construction area. This bypass will continue to be available for emergency purposes now that the plant is completed and operating. Seventy feet of 84-in. concrete pipe was also installed in the new plant as the effluent line from the final filtration tanks to the two 5,000,000-gal underground suction reservoirs.

Numerous outdoor installations

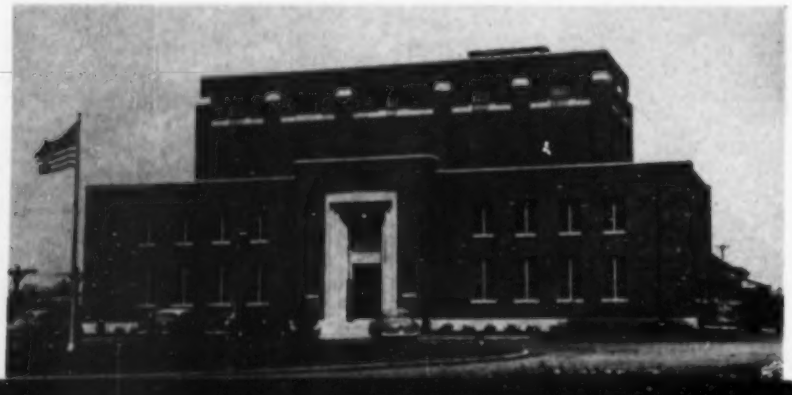
Dayton's new Water Purification and Softening Plant has a number of outdoor installations. These include four settling basins, each 333 ft long by 90 ft wide by $17^1/_2$ ft deep; four slow-mix basins, each 349 ft long by $19^1/_2$ ft wide by $17^1/_2$ ft deep; and four recarbonation chambers, each 90 ft long by 15 ft wide by $17^1/_2$ ft deep. One settling basin, one slow-mix basin, and one recarbonation chamber make up a complete unit and can be operated as such.

Lime, soda ash, and alum are introduced into the raw water as it enters the plant. It then flows into the slow-mix basins where the floc is built up, after which it travels slowly through the settling basins. From here the water passes through the recarbonation chambers where CO_2 is added to reduce alkalinity. This stabilizes the water so that the filtration sands are kept from "growing" and do not have to be worked or replaced frequently.

After leaving the recarbonation chambers the water (now softened) flows through the two 72-in. concrete pipes to each end of the pipe gallery in the indoor part of the plant. The indoor filtration section contains 16 individual filters, each having an area of about 1,400 sq ft. The water is filtered through 26 in. of graded filter sand and 24 in. of graded gravel. This rapid sand filtering process removes the remaining bacteria and solids from the water.

The ever increasing cost of operation and the financing of the huge water-works expansion program required additional funds. Therefore, early in 1951, the City of Dayton increased its water rates for the first time in 23 years. Today's rates are considered average for cities of our size. They range, in six pay blocks, from $2.10 minimum per quarter, including 1,000 cu ft of water, to $0.50 per 1,000 cu ft for all water consumed over 1,000,000 cu ft.

Completed water treatment plant was formally dedicated on May 27, 1953, about two years after ground was broken—on May 15,1951. Plant is operated by force of 22 men.



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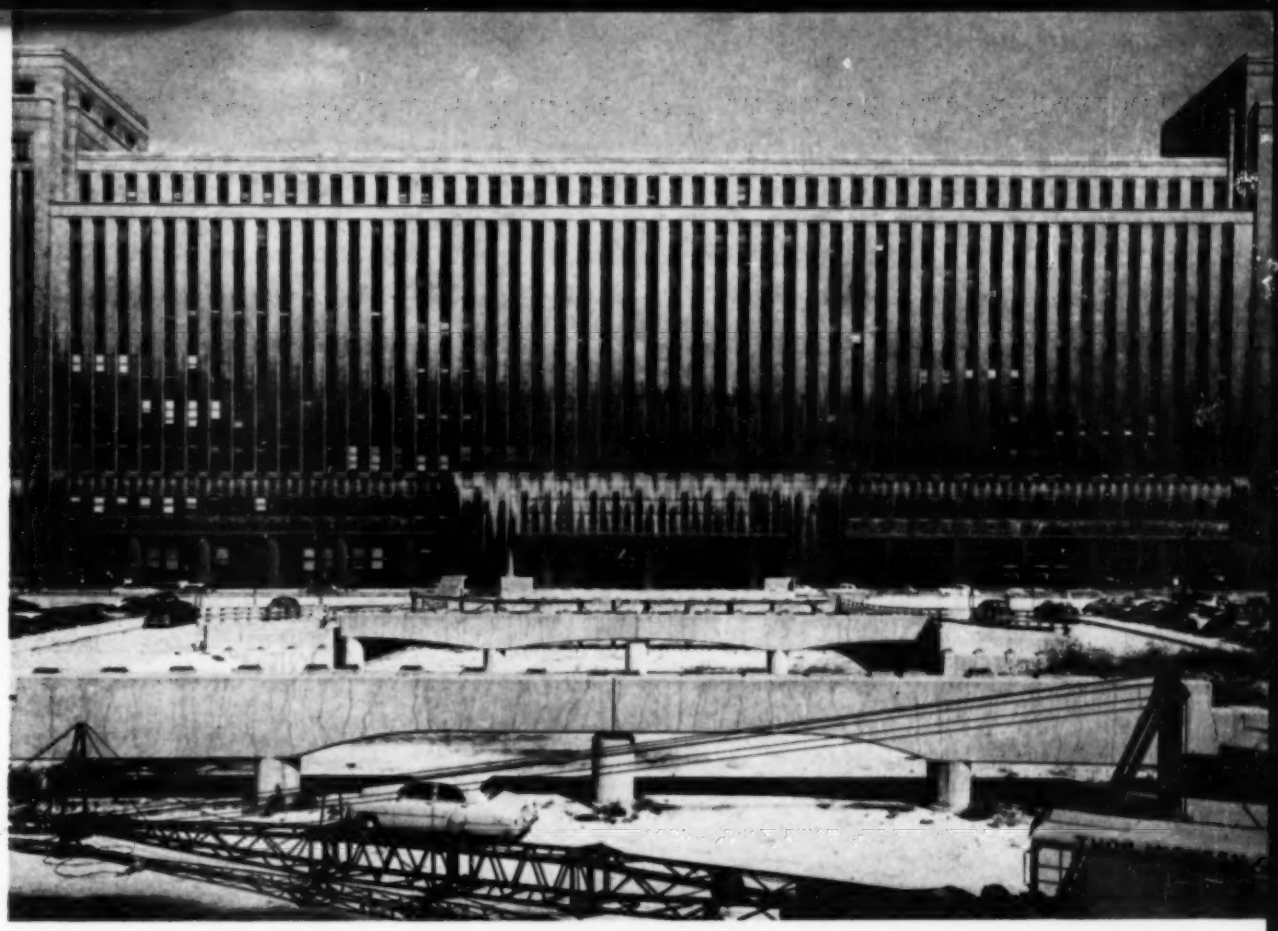


Superhighway will pass through U.S. Post Office Building. Although construction of highway was anticipated in design of building, it was nevertheless necessary to relocate truck ramps and traffic flow within building. Concrete bents in foreground await placement of concrete decking.

V. E. GUNLOCK, M. ASCE, Commissioner of Public Works, Chicago, Ill.

Buildings no barrier to Chicago's Congress Street Superhighway

The Congress Street Superhighway, long a dream of Chicago city planners, is an east-west artery cutting across the city from the shore of Lake Michigan on the east to the city limits on the west (Fig. 1). This superhighway eight miles long, with four traffic lanes in each direction and a median strip which includes rapid-transit tracks, is rapidly becoming a reality.

Although approved in 1940 by council ordinance as a main trunk in the 67 miles of comprehensive superhighways for the city, actual construction of the $92,000,000 super road did not begin until December 1949, when building of the drainage system was started. The intervening time had been devoted to the acquisition and clearing of the right-of-way required for this great traffic artery. The cost of the right-of-way, upon which stood a variety of buildings from one-story frame garages to three-story apartments and 12-story steel structures, ran into millions of dollars. One 5-story structure of quite modern construction which had housed an ink plant was purchased and moved intact one block from its original site.

It was a long and tedious process, embracing the preparation of ordinances and agreements, committee and council meetings, sessions with property owners and real estate advisory committees, and frequent court proceedings—all those delays which harass big projects before property titles can be acquired. Eventually the air was cleared, as it were, of the numerous preparatory details, right-of-way was purchased and cleared, and now construction is in full blast at

Construction view of superhighway shows some of urban construction problems encountered. Part of structure is elevated and part in open cut. In course of construction, buildings were moved or arcaded, and rail facilities were moved.

various points all along the route. Roughly, the Congress Street Superhighway is about 50 percent completed, with a target date for completion set for the end of 1955 or early in 1956.

The tracks of the Chicago Transit Authority, to be placed in the median strip, will provide mass rapid transit to the West Side of Chicago. This line will be an extension of the present Milwaukee-Dearborn-Congress subway, whose present terminus is in Congress Street under the west bank of the South Branch of the Chicago River. From this point it will be extended undergound, for a distance of four blocks, beneath the giant U.S. Post Office Building, to S. Halsted Street, whence it will emerge into the median strip of the Congress Street Superhighway.

Since the superhighway from this point on to the city limits will be built in a depression from 10 to 15 ft below grade, the rapid transit carrier has been designated as an "open-cut subway."

Two large interchanges

The Wells Street Plaza will be an outstanding example of a modern traffic facility, by means of which, even in a congested area, turning movements to and from the Congress Street Superhighway can be made without the restrictions of stop signs or crossings. It will be located in the area bounded on the west by the South Branch of the Chicago River, on the south by Harrison Street, on the east by Wells Street, and on the north by Van Buren Street. About 90,000 vehicles will pass daily through this interchange, of which 20,000 will use the curved ramps. Turning traffic will be distributed by way of S. Franklin Street and through the lower level of S. Wacker Drive, another of Chicago's super roads now under construction.

The Halsted Street traffic interchange will form the junction of three major routes of the Chicago comprehensive superhighway system —the Congress Street Superhighway, the Northwest Route, and the South Route. Like the Wells Street Plaza interchange, it will consist of a series of curved ramps.

In passing it may be well to mention that the Northwest Route, in addition to tapping the great and rapidly growing Northwest Side of the city with a super road, will also be the avenue for rapid transportation between the Loop and the great O'Hare Field now being developed for commercial aviation. It is estimated that when completed, this interchange may handle up to 170,000 vehicles in a 24-hour period, which may well win it the title of the "busiest crossroad in the world."

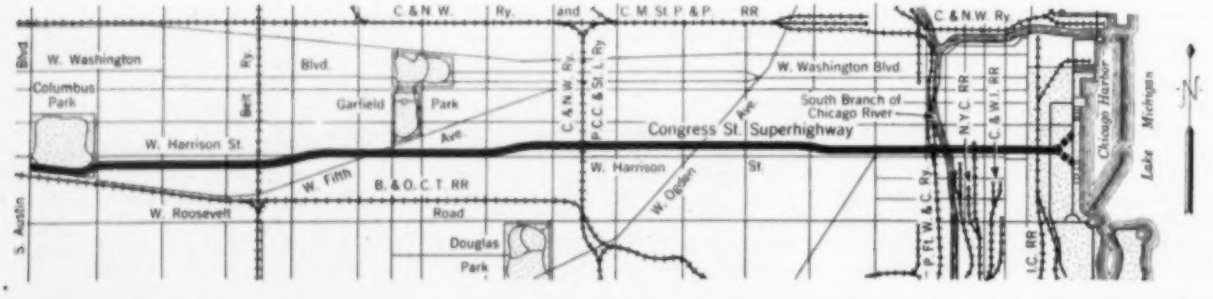
FIG. 1. Superhighway is east-west artery, extending 8 miles from Lake Michigan to city limits on west. It will be extended by the county another 8 miles to the west to connect with one of main state highways.

A highway through the Post Office

One of the complicated engineering feats of the Congress Street Superhighway will be its projection through the 13-story U. S. Post Office building which stands just west of the South Branch of the river on S. Canal Street between W. Harrison and W. Van Buren Streets. The problem is the rerouting of post-office traffic within the building.

When the post office was built in 1933, an arcade 120 ft wide and 22 ft high was provided for the superhighway, but this provision was later overlooked or forgotten. In any event, mail-truck ramps were built from the first to the second floor having as their only access the proposed roadways for the expressway. In order to utilize the arcade for its original purpose, as right-of-way for the superhighway, it will be necessary to provide new ramps and access to them for the mail trucks. After prolonged discussion, an agreement has been reached between the city and the federal government for sharing the costs of the necessary alterations, which will total around $1,328,000.

The highway through the post



Above: "Siamese-twin" bascule, to span South Branch of Chicago River, will cost $5,000,000. Each pair of meeting leaves can be operated separately when required for repair of other pair.

Left: Typical of interchanges distributing traffic to and from downtown area is Wells Street Plaza, with its curved ramps, estimated to handle 90,000 vehicles daily.

office will consist of an east and a west roadway, each 38 ft 6 in. wide, with a median strip of 6 ft 10 in. The roadbed will be a 7-in. reinforced concrete slab, set on reinforced concrete beams and columns. The new roadways and their supports will rest on the present structure of the post office building. The roadways through the building will be enclosed in glazed hollow-tile walls, to separate them completely from post-office operations. To provide access to the ramps that now connect with the arcade roadways, a new driveway solely for the post office will be built.

During the construction work through and beneath the post office building, it will be necessary to remove the lower sections of eight existing caissons which are in the path of the tunnel for the Milwaukee-Dearborn-Congress subway, to be extended to its portal in the median strip of the highway. Temporary shores and cribbing will take the column loads during subway construction. When the subway is completed the load will be transferred to the top of the tubes.

Through the LaSalle Street Station

A situation similar to that in the U. S. Post Office Building was encountered in building the Superhighway through the LaSalle Street Railway Station. Here too, the Milwaukee-Dearborn-Congress subway lies beneath the highway. Substructures for the highway were being built during the tunneling job on the subway tubes. It was a ticklish job for a while, as it was necessary to do the work while trains were operating above. It required several months of round-the-clock vigils over jack screws under about 80 or more columns, to prevent settlement which would have thrown the railway tracks above out of operation.

It will also be necessary to relocate a street in connection with this job, as certain baggage and mail-room facilities were in our right-of-way, and to restore them it will be necessary to relocate the street on which they fronted to a location about one block west. The substructures for our work in the station area are completed and the work of restoring station facilities is well under way.

Whereas we had to move a street in the right-of-way at one end of the new superhighway, at the other end we had to move the major portion of one of the West Side elevated railway facilities. The Garfield Park line, from the West Side into the Loop, stands in the center of the Congress Street Superhighway location for a distance of about $2^1/_2$ miles. It was necessary to build inclined structures at the east and west ends of this section to reroute the elevated railroad traffic into the street level of Van Buren Street, where it will operate by third rail until the superhighway is completed. The trains will then run on the tracks in the median strip which are to be completed at the same time as the expressway. Work on removal of the elevated line has been started.

A similar situation arose in working on the Douglas Park elevated line, which connects with the Garfield Park line and crosses the Superhighway. It was necessary to build a connection over the superhighway to the Logan Square line and reroute the Douglas Park traffic by way of a West Side line on Lake Street.

Siamese-twin bascule

A new giant bridge—the Wagner Memorial Bridge—to span the South Branch of the Chicago River just east of the U. S. Post Office, is under construction. Its estimated cost is put at $5,000,000. It is of the "Siamese-twin" bascule type. It was impractical to employ the usual two-leaf design because of the great roadway width required for the 8-lane highway, the sharp bend in the river channel in that area, the proximity of railroad facilities on the west side of the river, and the traffic-interchange driveways on the east side of the river.

Instead of one leaf from each side of the river meeting at the center, this bridge will consist of two independent leaves on each side, or a total of four leaves. The two north leaves are echeloned 31.6 ft westward with respect to the two south leaves, to conform to the slant in the channel. The operating machinery on each side of the river will be connected mechanically and electrically, so that the two

Close-up of elevated section of Congress Street Expressway shows expansion rollers and down-spouts for roadway drainage.

City officials observe arrival of first steel for Congress Parkway bridge. Shown (left to right) are Mayor Kennelly, the author, Chief Engineer Van Gorp, and Bridge and Viaduct Engineer Michuda.

adjacent leaves can be operated as a single unit. They can also be operated separately in case repair work necessitates putting one pair of meeting leaves out of service.

The new bridge will be of the deck type with trusses entirely beneath the roadways. Each leaf will consist of a roadway 43.25 ft wide, a sidewalk 9.67 ft wide, and one-half of a 4.5-ft median strip, for a total overall width of both leaves of 110.34 ft. The bridge will provide a clear navigable channel width of 169 ft, measured from the northwest bridge pit at right angles to the northeasterly dock wall, and will have a maximum vertical clearance of 21 ft above the river for a width of 114 ft at right angles to the slanted channel.

Another job of no particular engineering difficulty but involving the expenditure of considerable time, was the cutting off of the Western Union Building, a seven-story brick and steel structure 102 ft wide which jutted into the right-of-way of the superhighway for 35 ft. Preliminary to cutting the jutting section away, it was necessary to relocate a maze of telegraph equipment, printing machines, pneumatic tubes, stock tickers, power lines, cables, and other facilities. The whole job required an expenditure of more than $870,000.

Drainage from the Congress Street Superhighway will be carried through a system designed to accommodate the rainfall from an area of 250 acres which formerly flowed into city sewers. The new drain, in effect, will be a relief sewer for these sewers. The drain is roughly horseshoe shaped, 8 ft high inside and more than 7 ft in width. It is of reinforced concrete, with walls more than 1 ft thick.

This drain parallels the highway all the way from the Chicago River westward to the city limits. At its eastern terminus a pumping station has been constructed, which will lift the flow—by gravity to this point—up to an old condenser water tunnel for discharge into the Chicago River. The pumping station is being equipped with three 7,000-gpm and two 3,000-gpm pumps. Space has also been provided for one additional 7,000-gpm pump.

Insufficient width of Congress Street at east end made it necessary to incorporate sidewalks in right-of-way and provide new sidewalk area by building arcades into buildings. Completed arcade shown runs under edge of Sears-Leiter Building.

Arcades replace sidewalks

The east end of Congress Street, between Michigan Avenue and State Street, lacked the width required for the new highway as stipulated in our plans. Since this is an area of large steel and concrete structures, the cost of cutting them off to meet our dimensions would have been prohibitive. The problem was solved by building arcades into the buildings which stood in our path. The original sidewalk area was taken for the superhighway right-of-way on each side of the street, and the new sidewalk area was secured by building the arcades. The arcades average 18 ft in width and are of simple and dignified design.

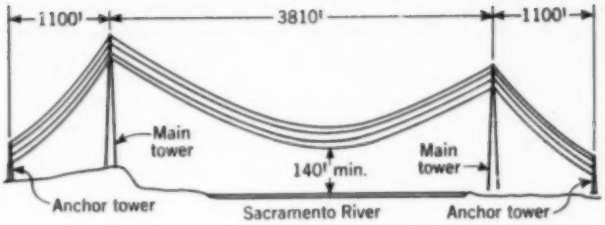
Arcading of several buildings is completed. Among those remaining to be altered in this way is the Congress Hotel and the old Auditorium, now housing Roosevelt College.

In the foregoing description, the Congress Street Superhighway has been traced across eight miles of the city. However, it will not come to an end at the city limits, but will be extended by the county another eight miles westward to the Cook County line, where it will join with one of the main state highways. Considerable work has already been done by the county on overpass bridges and grading.

The Congress Street Superhighway, along with the other superhighway routes of the county comprehensive system, is integrated with the state system and the federal-aid system. Because these superhighways are designed as part of an overall system, the other agencies are cooperating in their construction. By agreement, the city, county, and state will share equally the cost of the superhighways within the city, and the county and state will share equally the cost of the system within the county, but outside the city. The state will use its federal-aid money as part of its share, so there are actually four parties involved. This becomes five parties in some cases where the Chicago Park District or the Chicago Transit Authority is involved.

It is necessary to utilize the combined efforts and funds of all these agencies because of the magnitude of the work and the cost involved. Motor fuel tax funds and bond funds are the principal sources of city financing.

When completed, Congress Street Superhighway will carry eight lanes of traffic eight miles across heart of Chicago. Median strip will accommodate four tracks for rapid transit service. Estimated cost of this city-planner's dream is $92,000,000.



GEORGE E. SCHUMANN, M. ASCE

Chief Consulting Design Engineer

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Division of Henry J. Kaiser Co.

Oakland, Calif.

Transmission towers

437 ft high support span of 3,810 ft

Sacramento River crossing of Shasta-Tracy transmission line involves unusual design considerations

The design of transmission towers in the United States has followed certain patterns, and in many cases theoretical designs have been supplemented by tests on full-size towers. Within certain height limits, the design of towers presents only minor difficulties. Where large bodies of water have to be crossed, however, towers of considerable height become necessary and the long spans increase the wire pull on these towers. Radio towers of considerable height have been built but they are not subject to large horizontal forces at the top and they are very often steadied with guy wires. The design of 437-ft towers with four cross arms 39 ft long carrying the Shasta-Tracy transmission line 3,810 ft across the Sacramento River, with wire pulls of 13,500 lb, presented an interesting problem to Kaiser Engineers, who designed these towers for the U. S. Bureau of Reclamation.

It may be of interest to mention, for the benefit of engineers not familiar with tower design practice, that the material generally used is ordinary structural steel, except where the tower height is excessive, when an alloy steel is more economical. The allowable stresses, in tension or compression, are of course a function of the yield point of the material, and the Bureau of Reclamation recommends 22,000 psi for steel with a yield point of 33,000 psi, and 30,000 psi for alloy steel with a yield point of 45,000 psi. The L/r ratio generally governs the design of compression members, and the difference in allowable stresses as specified by the Bureau of Reclamation is interesting.

For axially loaded columns, specifications permit a design stress of

$$22{,}000 - 98\ L/r$$

with a maximum of 16,600 psi for mild steel with a 30,000-psi yield point; and

$$29{,}000 - 126\ L/r$$

with a maximum of 21,600 psi for alloy steel of 45,000-psi yield point. For eccentrically loaded columns, the allowable stresses were respectively, $17{,}000 - 58\ L/r$, with a maximum of 14,000 psi, and $22{,}000 - 70\ L/r$, with a maximum of 18,300 psi.

In a transmission tower constructed mostly of angle sections, it is not easy to differentiate between axial load and eccentric load. Axially loaded members are assumed to be either corner posts, single-angle sections connected by both legs, or double-angle or star sections.

Another factor governing the design of compression members is the unsupported length to be considered. It is a well-known fact that the free length of a compression member subject to buckling varies with the method of end connection. It is important not only to determine the correct value of L, but also to choose the correct radius of gyration to be used in a given case, as the value of r varies greatly with various angle sections.

Design assumptions used

The following assumptions were used in the design of the towers for the Sacramento River crossing:

Secondary members were considered to give full support in the plane in which they are placed. The unsupported length was taken as the full distance between points of support *without* reduction for fixed-end conditions. This requirement is certainly to be considered on the safe side although some engineers might not be willing to agree that this assumption is proper for continuous members, or for members that are rigidly fixed at their ends.

For a double web system, where the crossed diagonals are bolted at their center section, the maximum L/r for the various members was governed by the following criteria:

1. L is the greatest distance from the point of intersection to either end connection, and r is the minimum radius of gyration of the member.

Two towers for Sacramento River crossing carry wire pulls of 13,500 lb each. Base is designed to resist unequal settlement as well as horizontal earthquake forces.

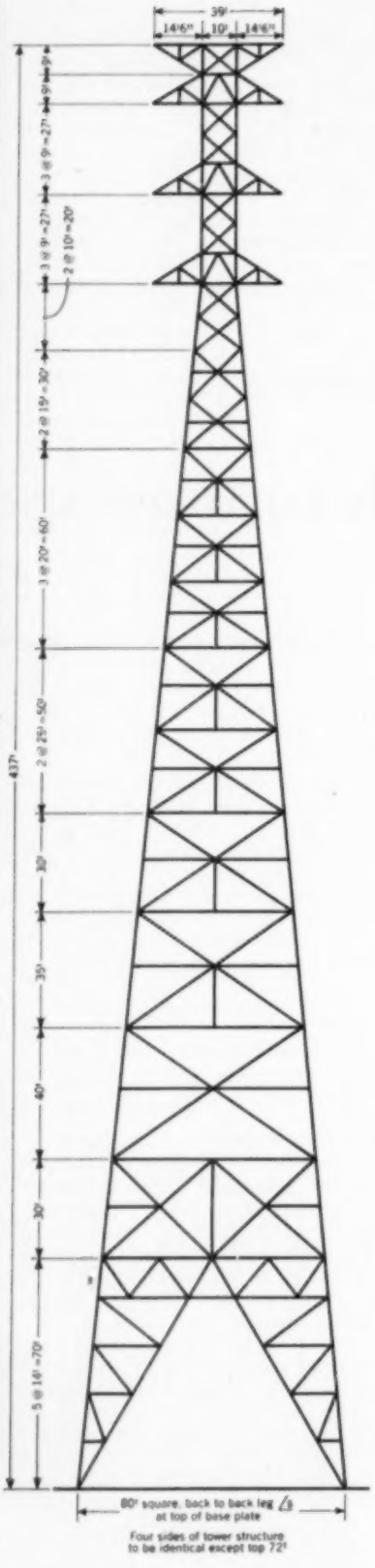


FIG. 1.

2. L is the distance between end connections, and r is the radius of gyration of the member when its axis is parallel to the plane of the web system.

3. For a single-angle member with an intermediate support in one plane at its center, the maximum L/r shall be determined from the following criteria:

(*a*) L is 0.7 times the distance between end connections and r is the minimum radius of gyration of the member; or
(*b*) L is the distance between end connections and r is the radius of gyration of the member when its axis is parallel to the supporting member.

4. For a single-angle member with more than one intermediate support in one plane, the maximum L/r shall be determined from the following criteria:
(*a*) L is the maximum subpanel length and r is the minimum radius of gyration of the member; or
(*b*) L is the distance between end connections and r is the radius of gyration of the member when its axis is parallel to the supporting members.

The bending stresses for tension were taken the same as for direct tension, but the compression stresses due to bending were controlled by the ratio of length to width of the compression flange L/b, this ratio not to exceed 40.

These stresses were specified to be

$$\frac{24{,}800}{1 + \dfrac{L^2}{1{,}800\ b^2}}$$ with a 22,000-psi maximum

FIG. 1. Elevation of tower shows detail of bracing. Limited length of galvanized members and desirability of keeping splices near panel points dictated spacing of panels.

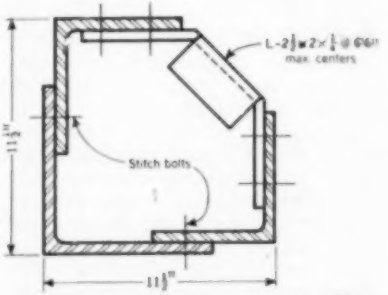


FIG. 2. Main tower members are built up of three angles stitch-bolted together. Welding was prohibited because of galvanizing.

for steel with a 30,000-psi yield point; and

$$\frac{33{,}600}{1 + \frac{L^2}{1{,}800\ b^2}}$$

with a maximum of 30,000 psi for steel with 45,000-psi yield point. Combined bending and direct stresses were based on $22{,}000\left(1 - \frac{p}{p_1}\right)$, or $30{,}000\left(1 - \frac{p}{p_1}\right)$, where p is the actual stress in the member, and p_1 the allowable direct stress without bending.

For determination of net areas, bolt holes were assumed to be $^1/_8$ in. larger than the bolt. For a single-angle section, tension members were designed with the net area of the connected leg plus 50 percent that of the unconnected leg.

Other design considerations that present only a slight problem in average towers can become rather involved when unusually large wind loads on long members, of considerable sectional area, are involved. The problem of an economical choice of panel lengths enters the picture, as the unsupported lengths are not only influenced by the L/r ratio in their design, but dead-weight moments as well as wind moments complicate the design, inasmuch as the larger sections offer greater areas to the wind. For instance, a panel 40 ft long presenting a face 13 in. wide to the wind, at 20 psf, is subjected to quite a bending moment due to wind in addition to the dead-load moment due to the slope of the member. Therefore it became necessary to reduce the unsupported length by introducing an additional horizontal member in the web system (Fig. 1).

Galvanized members bolted

Another problem arose in the selection of the cross section of the main tower members for these extra-tall towers. In most transmission towers a single angle, or double angles or channels, will suffice to take care of the stresses, but in this case the main members had to be built up of three angles stitch-bolted together to act as one unit (Fig. 2). It should be noted that welding was not allowed because of the galvanizing, and the facilities to handle long members in the galvanizing tanks limited the length of the members.

The fact that all connections were to be bolted and that welding was prohibited not only increased the amount of steel used but also the difficulties of splicing. Splices of individual angles were offset. The change of section from a one-angle section to a three-angle section was also a problem because of the ensuing change in the location of the center of gravity of the respective members, and the resulting introduction of secondary bending stresses. This condition required splices to be made as close as possible to a joint, so that adjoining members could help absorb the secondary moment.

Thus, in determining the lengths of the main members, it was necessary to consider not only the available galvanizing facilities but also the need to locate splices near panel points. The panel lengths were subdivided to reduce the unsupported length to a minimum of about 20 ft. The lower part of each tower leg was built as a truss portal frame to provide resistance against unequal settlement of the piers as well as against anticipated horizontal earthquake forces.

Another problem was the anchorage of the tower legs to the foundation (Fig. 3). Special study was given to make the center of gravity of the anchor bolts coincide as closely as possible with the center of gravity of the tower-leg section in order to produce an equal pull on each bolt, as well as to eliminate secondary bending in the anchorage.

The towers were designed by Kaiser Engineers under the direction of George Havas, M. ASCE, chief engineer and general manager, and design engineers F. B. Tobias, A.M. ASCE, F. X. Kast and Ken Olsen, A.M. ASCE, under the supervision of the writer. Kaisaloy high-strength steel for the construction was furnished by the Kaiser Steel Corporation of Fontana, and fabrication and erection were performed by the Emsco Derrick and Equipment Company of Los Angeles. The foundations were designed in the Bureau of Reclamation office at Denver, Colo.

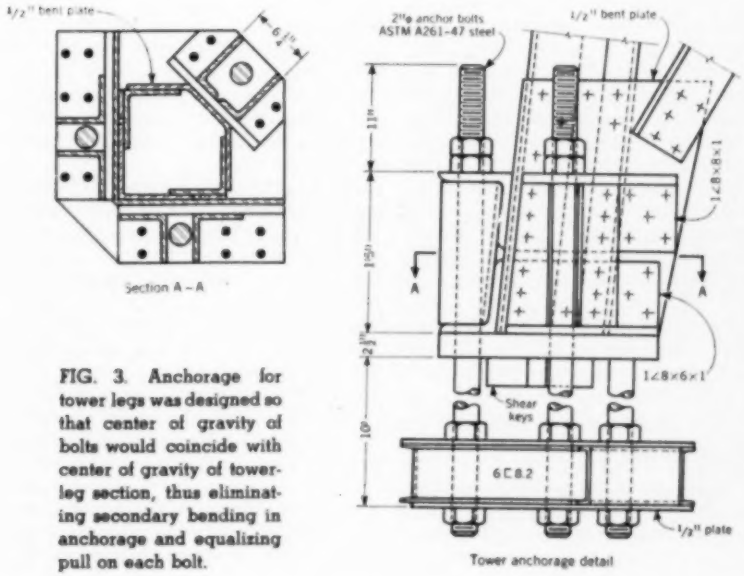
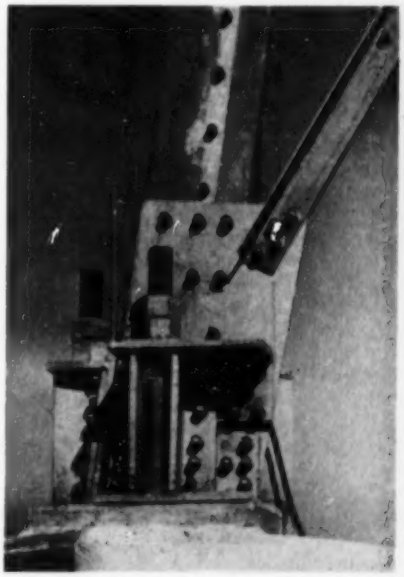
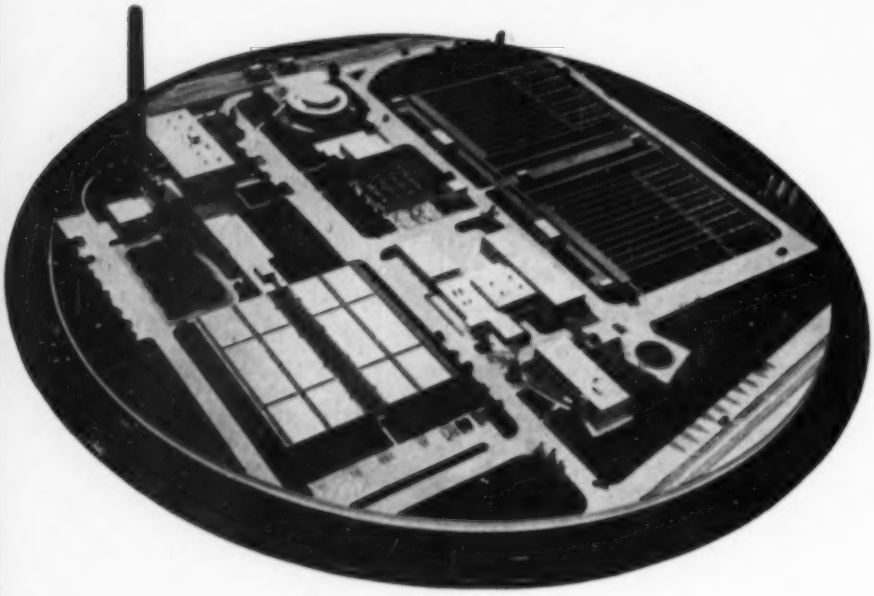


FIG. 3. Anchorage for tower legs was designed so that center of gravity of bolts would coincide with center of gravity of tower-leg section, thus eliminating secondary bending in anchorage and equalizing pull on each bolt.



Pittsburgh



Model of Pittsburgh Sewage Treatment Plant was built to scale to show features designed to reduce B.O.D. 50 percent on load of 150 mgd. Plans and specifications are already complete and construction is expected to start in 1954—as soon as plans are approved and construction agency is chosen.

After more than 40 years of studies and reports, Pittsburgh and 63 of its suburbs have finally agreed on a plan for abatement of stream pollution. For 25 years after the first report was submitted by a board of consulting engineers in 1912, there was little or no activity until a WPA project began studying the problem. However, it was not until 1945, when the Pure Streams Act was passed by the Legislature as an amendment to a similar Act of 1937, that real activity developed on the part of the municipalities and industries, finally resulting in the formation in 1946 of the Allegheny County Sanitary Authority, which was empowered to make a study and report on a county-wide basis, that is, a metropolitan plan of collection and treatment of sewage and industrial wastes.

The Sanitary Authority presented its report in January 1948. The recommended plan provided service to 102 municipalities with a single sewage treatment plant which would have produced a most complete abatement of pollution of the streams in the Pittsburgh area to a point 3 miles downstream from the Golden Triangle, where the plant was to be located. However, because of a lack of support in the right places, the metropolitan project broke down. The present Pittsburgh project is designed to serve 64 municipalities, including the City of Pittsburgh, for an estimated connected population of 1,400,000 in 1970 and 1,650,000 in the year 2000. The population equivalent load (including industrial sewage) in 1970 is estimated at 1,900,000.

The other 38 municipalities elected to shift for themselves. Instead of one sewage treatment plant to serve the metropolitan area originally proposed, there will now be more than 20. Thus, the first opportunity to gain utility service on a metropolitan basis in the Pittsburgh area was rejected. The suburban municipalities are largely to blame for this situation because they failed to meet the challenge of the Mayor of the City of Pittsburgh to show their interest and good faith by executing long-term agreements with the Sanitary Authority for service on a metropolitan basis. Of the 102 municipalities, only Mt. Lebanon Township and Pitcairn Borough indicated they would be ready to sign such an agreement.

Under the adopted project, long-term agreements based on the issue of 40-year revenue bonds supported by sewage charges have been executed between the Sanitary Authority, the City of Pittsburgh, and the other 63 participating municipalities. Plans and specifications are practically completed and the project will be ready for construction in the spring of 1954. Under the agreements, the City of Pittsburgh reserves the right to select a sewage agency other than the Sanitary Authority to issue bonds and carry on the construction. The estimated cost of the project, not including administration, engineering, land, rights-of-way, and interest during construction, is $67,000,000 at July 1953 prices. To cover all these items, the revenue bond issue would need to be $85,000,000. A pay-as-you-go plan recommended in the Sanitary Authority report of January 1948, to finance such expenses as the cost of engineering and interest during construction by partial sewage charges, was rejected by the City Council of Pittsburgh.

Plant designed for 150 mgd

The adopted project consists of a 150-mgd sewage treatment plant providing for 50 percent removal of biochemical oxygen demand (B.O.D.) and 63.5 miles of intercepting sewer, of which 32 miles will be in deep tunnel. Six minor sewage pumping or ejector stations will serve branch interceptors. The intercepting sewer system, 59 miles long, will conduct the flow by gravity to a central pumping station at the treatment plant site.

Unusual features of the intercepting sewer system are the types of diversion works, including vertical drop-shafts to carry the intercepted sewage from the outfall sewers to the intercepting sewer; the method of operating the tunnel section of the intercepting sewer, as a flooded conduit under pressure; and the type of construction proposed for the intercepting sewer, in tunnel.

Early studies of storm-flow interception practice in the United States showed that there was no consistent agreement on the amount of such flow which should be designed for. In many cases 400 percent of the dry-weather flow was assumed as proper, and in some cases even 1,000 percent was not considered too great. The Sanitary Authority engineers, after an exhaustive study of the subject, including the polluting effect of storm flows on river conditions, decided that interception of storm flow to the extent of 250 percent of the dry-weather flow, automatically cut back to 150 percent after the first street wash was

plans unique project to abate stream pollution

JOHN F. LABOON, M. ASCE, Chairman of the Board and Chief Engineer,
Allegheny County Sanitary Authority, Pittsburgh, Pa.

Vertical diversion structures up to 150 ft deep will feed 10½-ft interceptor in tunnel

intercepted, would serve the Pittsburgh area to best advantage. Every effort was made to dispense with float-operated devices for diversion structures and to keep the number of moving parts to a minimum.

Vertical drop-shafts ranging from 20 to 150 ft in height are necessary to connect the existing outfall sewers to the intercepting sewer that is in tunnel. Precedent for such design and construction was lacking. As a consequence, a research project was initiated at the Carnegie Institute of Technology with Louis M. Laushey, J.M. ASCE, as project supervisor under the direction of F. T. Mavis, M. ASCE. Model studies were made in the hydraulic laboratory of the flow in vertical tubes 6 in. in diameter and 30 ft high, similating the flow in drop-shafts. As a result of these studies, factors were established for the design of entrance chambers and drop-shafts (Fig. 1). These studies included measurement of the quantity of entrained air.

Another study made later in the laboratories of the Sanitary Authority under the guidance of Prof. Harold A. Thomas, M. ASCE, former head of the hydraulic laboratory at Carnegie Institute of Technology, with the cooperation of Dr. Laushey of the Institute, developed the character and quantity of air flow upward in drop-shafts partially filled with water so that provision could be made in the design for venting air drawn into the tunnel intercepting system with the sewage flow.

Two types of diversion works have been designed, one consisting of tilting gates of the Chicago Sanitary District design (Fig. 2), and the other consisting of fixed orifices (Fig. 3). In both cases, the diversion controls are designed to reject all storm flow greater than 250 percent of the dry-weather flow. When this flow is reached after the first flush of storm flow, the tilting gates cut the flow back automatically to 150 percent of the dry-weather flow by means of unbalanced hydraulic pressures on these gates.

The fixed-orifice type of control has been utilized generally in the diversion works of the intercepting sewer serving the Chartiers Creek and the Turtle Creek areas, where backwater control of the orifices was made possible by designed hydraulic gradients. In such cases two orifices in sequence have been included—one generally of rectangular type as an outlet control from the outfall sewer, and the other a replaceable circular type, with reduced area of opening, as an outlet from the diversion structure to the intercepting sewer connection. A master control has been included at the terminus of the Chartiers Creek and Turtle Creek intercepting sewers, ahead of their connection to the tunnel main, to further regulate the flow from these areas.

Spiral motion in drop shafts

The model studies indicated that the structure at the top of the drop-shaft should be so designed that a spiral motion would be developed in a well at the top. Tests showed that such a spiral motion would cause the water to enter the drop-shaft in a relatively thin cylindrical section, the circular motion causing it to hold

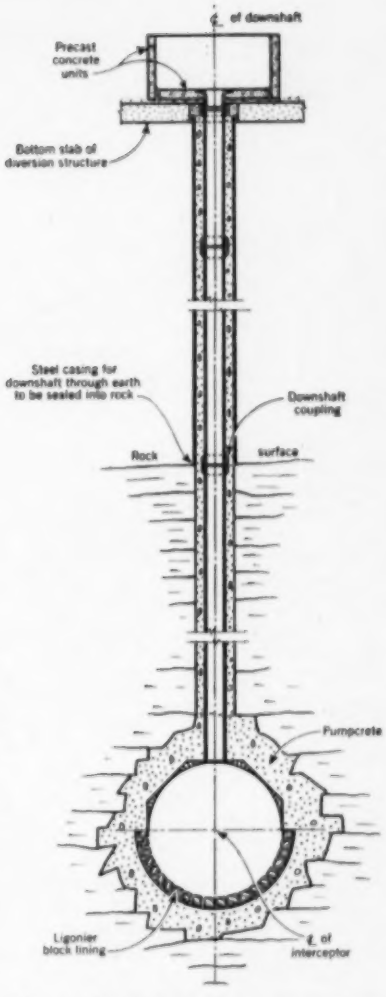


FIG. 1. Vertical drop-shafts in system range in length from 20 to 150 ft. They generally range in size from 8 to 12 in. in diameter, but a few have 36-in. diameter. Maximum flow in any drop-shaft is 70 cfs.

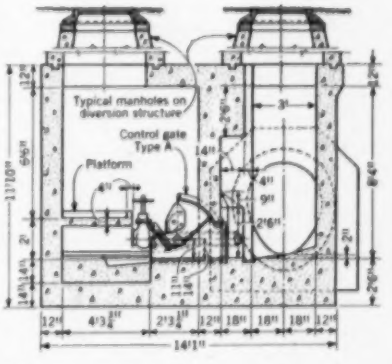


FIG. 2. Diversion structure at Fourth Street sewer is typical of those using tilting-type control gates. Flow is diverted from outfall through gate and down drop-shaft. Line of flow is eccentric to center line of drop-shaft so that falling sewage follows spiral path.

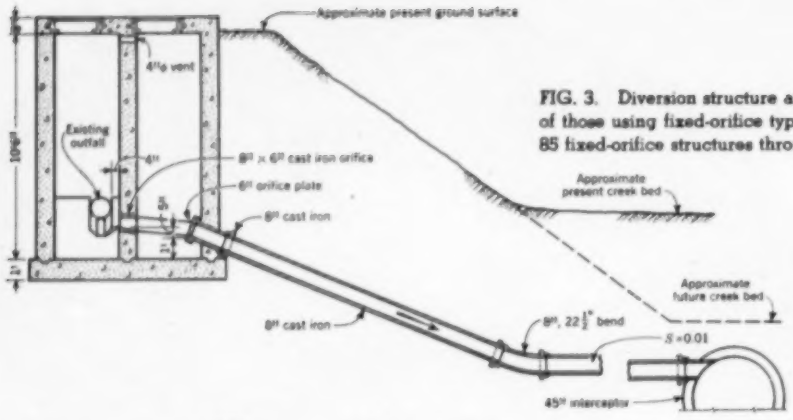
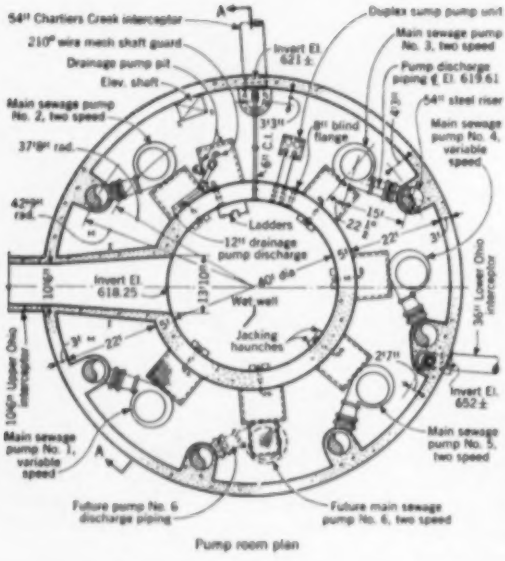
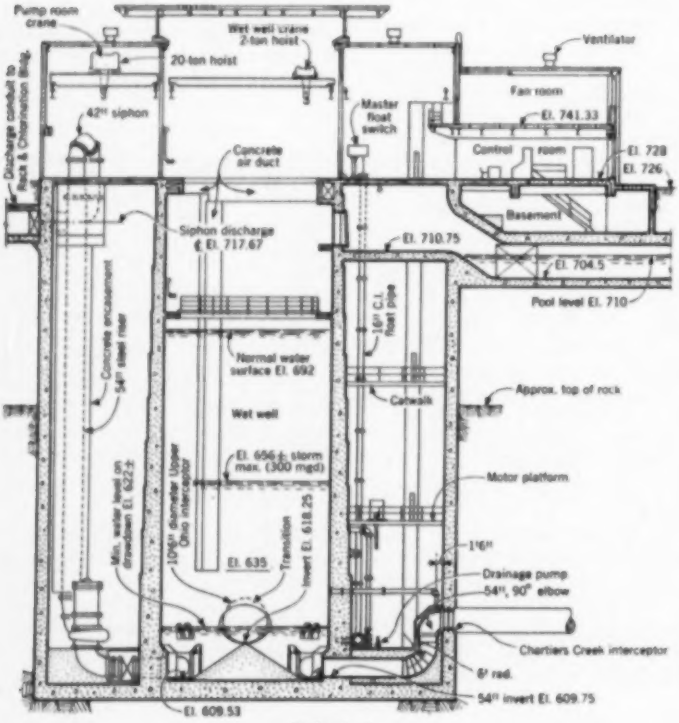


FIG. 3. Diversion structure at Turtle Creek is typical of those using fixed-orifice type of control. There are 85 fixed-orifice structures throughout system.


54" Chartiers Creek interceptor
210" wire mesh shaft guard
Drainage pump pit
Elev. shaft
Main sewage pump No. 2, two speed
37'8" rad.
42" rad.
Duplex sump pump unit
Main sewage pump No. 3, two speed
Pump discharge piping ℄ El. 619.61
54" steel riser
8" blind flange
Main sewage pump No. 4, variable speed
Ladders
12" drainage pump discharge
Invert El. 618.25
Wet well
Jacking haunches
10'0" Upper Ohio interceptor
36" Lower Ohio interceptor
Invert El. 652±
Main sewage pump No. 1, variable speed
Main sewage pump No. 5, two speed
Future pump No. 6 discharge piping
Future main sewage pump No. 6, two speed

Pump room plan

FIG. 4. Depth of water in wet well at circular pumping station is maintained at 74 ft. Wet well will be pumped down weekly to induce free flow of water with velocities of 4 fps to scour out settled grit. Eleven telemeter stations warn operators of flash floods, so that there is time to provide capacity in wet well.



Section A – A

against the inside of the drop-shaft by centrifugal force. The tests also indicated that no negative pressures or velocities inducive of cavitation would be developed. Using the principles of hydraulic similitude, the data from the model studies were extrapolated to rates of flow up to 70 cfs, the maximum capacity required for a drop-shaft in the intercepting system. From the results of the tests, curves were prepared for determining size of drop-shafts, and diameter and depth of wells for all required flows. The majority of the drop-shafts will be either 8 or 12 in. in diameter but a few larger ones are required, up to a maximum of 36 in.

The well at the top of each drop-shaft will be circular, and will have a diameter generally six times that of the drop-shaft in the case of the smaller shafts, and four or five times that of the shaft in the case of the larger shafts. The entrance to the well will be located tangentially at the outer edge in order to produce spiral flow in the well. The actual design provides for making certain drop-shafts serve as air vents as well as drop-shafts for sewage. In such shafts the upward flow of air is necessarily limited to the quantity that can rise without lifting the sewage level too high in the well through air-lift action in the shaft. This necessitates a larger shaft to provide for both upward flow of air and downward flow of sewage. At two points separate vertical shafts will be provided as air vents.

Of the 280 diversion structures provided for in the designs, 130 will be of the drop-shaft type with tilting-type control gates; 35 others not connecting to drop-shafts will also be equipped with tilting-type control gates; 85 will be equipped with fixed-orifice controls; and 30 are without any controls but are connected to other diversion structures containing either fixed-orifice or tilting-gate controls.

Flooded system adopted

A special study of the most economical and practicable method of operating the deep intercepting sewer system resulted in the adoption of a flooded system whereby the intercepting sewer, in tunnel, will be permitted to flood to a level 74 ft above the invert of the 126-in. intercepting sewer at its connection to

the wet well at the main pumping station. This level is determined by the hydraulic gradient reaching back to the Monongahela River intercepting sewer at Braddock, 12 miles upstream. This method provides the most economical pumping head, and at the same time reasonable velocities of flow in the tunnel. The wet well will be pumped down weekly to induce free flow conditions and obtain scouring velocities for the removal of settled grit. Velocities during pumping-down periods will be about 4 fps.

Another unusual feature is the provision of 11 telemeter stations at strategic points along the tunnel intercepting sewer transmitting liquid levels to a master board in the pumping station. Thus the operators will know where flash floods are occurring before the flow reaches the wet well and will be prepared to handle the situation at the pumping station by lowering the level in the wet well to provide a steeper hydraulic gradient for the anticipated increase in flow. The telemeter installation will serve as a check on the flow levels at important points as well as indicate the hydraulic gradient throughout the system.

Tunnel interceptor precast

Intercepting sewer in tunnel will be of precast concrete pipe of minimum thickness, backed up with Pumpcrete to completely fill the space between the pipe and the edge of the excavation. The intent of this design is to obtain a concrete lining having a special high quality of hardness, impermeability, density, and durability. A minimum length of 8 ft is planned for the pipe sections. The permitted types of joints are steel ring with lead or rubber gasket, tongue-and-groove with mastic and Concreteweld joints, and tongue-and-groove with rubber gasket. Concreteweld for finishing the joint inside the pipe is required for all joints.

Pumping station circular

The special feature of the pumping station is the wet well, which is a circular concrete structure 40 ft in diameter by 118.5 ft deep, located in the center of the circular pumping-station pit so as to permit short suction lines and a most economical construction arrangement (Fig. 4). The pumping-station pit is an annular space extending entirely around the wet well and having an inside diameter of 50 ft and an outside diameter of 94 ft.

Six 60-mgd vertical pumps, automatically controlled by the level in the wet well, will be located in the pump pit, but only five will be installed initially. Of these, three will be two-speed with synchronous motors, and two will be variable-speed with magnetic motors. The wet-well superstructure extends through the superstructure of the pumping station and thus permits ventilation at the roof by means of circular louvers the full circumference of the wet well. Another feature is the absence of check valves and gates on the pump discharge lines, which are equipped instead with siphon vacuum breakers.

The treatment plant consists of screens and grinders, aerated grit chambers, preaeration and sedimentation tanks, blower plant, sludge concentration tanks, incineration, pre- and post-chlorination, and an administration building. This will produce the 50-percent removal of the B.O.D. required for the present by the State Department of Health and the Ohio River Valley Water Sanitation Commission. The treatment plant is designed for a capacity of 150 mgd, representing 1970 requirements. The ultimate capacity for the year 2000 is estimated at 175 mgd. Conduits and channels are designed for a peak flow of 300 mgd, estimated for the year 2000. Space has been provided for future secondary treatment.

The grit chamber is patterned after the Columbus design, where aeration is provided for settling out the grit, except that modifications have been made to take advantage of data obtained from operating experience. These modifications include directional flow at the entrance and the provision of hoppers for grit storage and drainage.

Mechanically operated racks with a clear spacing of 1 in. and screenings grinders are included for each of the four channels. The grit chambers are designed for a detention period of 5 minutes at 150 mgd and air application of 5 cfm per foot of length. The preaeration tanks are designed for a detention period of 44 minutes, based on 150 mgd and 7 cfm of air per foot of length. The sedimentation tanks are designed for a 2-hour detention period and average unit loading of 1,350 gal per sq ft per day.

Raw sludge to be concentrated

The most unusual feature of the treatment plant is the method of sludge disposal. This method, developed in the Authority's laboratories and pilot plant, is believed to be unique. Raw sludge will be concentrated for 5 days and then incinerated. Laboratory and pilot plant experiments over a period of three years have demonstrated that raw sludge, preheated to 95 deg F and stored for a period of 3 to 5 days, will produce a concentration averaging 18 percent total solids by flotation. This method requires supplemental fuel for combustion. Fine coal, known to the trade as slack, and the cheapest to produce, will be mixed with the concentrated sludge immediately prior to incineration, or the two may be applied to the furnaces separately, depending upon the type of incinerator selected.

The design provides for a battery of 10 concentration tanks, one-half of one tank to be used as a raw-sludge compensating tank to serve the preheaters. The tanks will have a total capacity of 3,250,000 gal and are designed with sawtoothed bottoms in section, with longitudinal screw conveyors for homogenizing and removing the concentrated sludge. Warm air will be circulated above the sludge in the tanks and returned to the incinerators as combustion air, thus eliminating odors. The tanks are to be insulated.

Operation of tanks

Tests have shown that the heated sludge will rise to the top with subnatant forming on the bottom within 24 hours after heating. The subnatant can then be withdrawn and new raw sludge added as necessary according to the daily production, until the tank is full or until the day's load is provided for. The heated sludge will float again with the new sludge, and subnatant can again be removed. Subnatant will be returned to the effluent channels of the grit chambers. This method of operation requires the minimum number of tanks.

Following removal of the subnatant the concentrated sludge will drop to the bottom of the tank, whence it will be pumped to compensating tanks, and then to the incinerators. Disintegrators are to be installed ahead of the heat exchangers so that clogging material will be reduced to a minimum. Two-stage, progressing-cavity (Moyno) pumps will be used for the concentrated sludge.

As previously mentioned, the concentrated sludge will be disposed of by incineration. The average volume is estimated to be 144,000 gpd and the maximum 270,000 gpd. Its moisture content is estimated to vary from 76 to 84 percent. Bids will be taken on two alternate designs. One is based on the use of multi-hearth incinerators, the other on

(*Continued on page 100*)

Derrick-hoisted forms save time and

Use of a "form-lift" method for constructing an addition to the building of the Prudential Insurance Co. of America in Newark, N.J., pared construction and labor costs and permitted scheduling of completion within eight months from the initial ground breaking. The method basically consists of hoisting external wall forms from floor to floor as each pour is completed, using the same forms for the entire job.

The overall project, costing approximately $350,000, involves the erection of a 175 × 75-ft four-story reinforced concrete building to be used for the storage of paper rolls and other paper supplies.

The addition is tied to, and is an integral part of, the existing eight-story structure, which is a structural-steel fireproofed building with brick curtain walls, originally designed to carry the load of an addition. The addition is tied to the existing structure by steel wales around the perimeter at the second, third, and fourth floors and at the roof. The wales are fastened to the steel columns of the old structure by welded brackets.

In keeping with the type of loading (paper supplies), the second, third, and fourth stories are designed for a 150-psf live, and an 87.5-psf dead load. The roof is designed for a 40-psf live, and a 75-psf dead load. There were no special requirements affecting the design or engineering of the building.

Reinforced concrete construction was chosen because it was considered more economical for this type of structure. Floor loading is not excessive and there are no long-span requirements. A "monolithic" reinforced concrete structure also offers substantial economies in erection and external finish. This building is designed for an architectural concrete finish so that once the walls are poured all that is required is a cleanup of the exterior.

Excavation uncovers coal bunker

Historically interesting, and somewhat troublesome, excavation was encountered in breaking the ground for the building's reinforced concrete column footings. The area was formerly the site of an old foundry the foundations of which were found still intact. An old coal bunker filled with coal was also encountered. However, when these and other concrete and masonry obstructions were cleared, no further trouble was experienced in extending the foundations to good load-bearing shale, in some cases 14 to 16 ft below grade.

Air-entrained ready-mix 3,000-lb concrete was used, and approximately 2,000 cu yd were poured on the whole project. A wood tower approximately 75 ft high, equipped with a $1^1/_4$-cu yd trip bucket, was erected to hoist concrete delivered to the job site by transit-mix trucks. The trip bucket was raised and the concrete dumped into a $1^1/_2$-cu yd double hopper set at successive floor levels. The concrete was then taken from the hopper and placed in the forms by means of concrete buggies.

Outside wall forms are of a standard plastic-coated $^5/_8$-in. plywood of the stud-and-wale type, in basic section sizes of 37 ft wide by 14 ft high. The panel for the west wall was 53 ft wide by 14 ft high.

The height from the ground floor to the second floor was 16 ft; all other floor-to-floor heights were 13 ft 6 in. Up to a height of 6 ft 2 in. above the ground floor, the concrete wall was recessed to receive a brick veneer. Above this veneer, V-shaped rustications, spaced 4 ft 6 in. apart, encircled the building horizontally. Vertical V-shaped rustications above the brick veneer, and extending to the parapets, were spaced approximately 7 ft apart. These rustications give the building a paneled effect.

One line of horizontal rustication was detailed 10 in. below the finished floor at each floor level, and the next came 3 ft 8 in. above the finished floor. The specifications required that all concrete pours be stopped and started at lines of rustication. In order to comply with the specifications, a two-pour system was used. The first pour consisted of a 9-ft wall section up to the line of rustication 10 in. below the finished floor. The second pour consisted of interior columns, floor, and a section of spandrel wall 3 ft 8 in. above the floor. This two-pour system was continued to the roof and parapet.

The external wall forms were first erected in place, starting from the top of the recess for the brick veneer. The form panel was supported and clamped in place by $^5/_8$-in. bolts on 4-ft centers 4 in. below the top of the previously completed wall. It was also tied to the formwork for the floor. Snap ties of 3,000-lb capacity, placed on 2 ft × 2 ft centers were used to hold the inner and outer formwork together.

Hoisting the form

It took about 14 working days to complete a cycle of operations from floor to floor. The work included setting up the forms, placing the reinforcing rods, pouring the concrete, and setting. When a cycle was completed, preparations were made to hoist the forms for the next floor.

A single cycle of operations consists of the following steps in sequence:

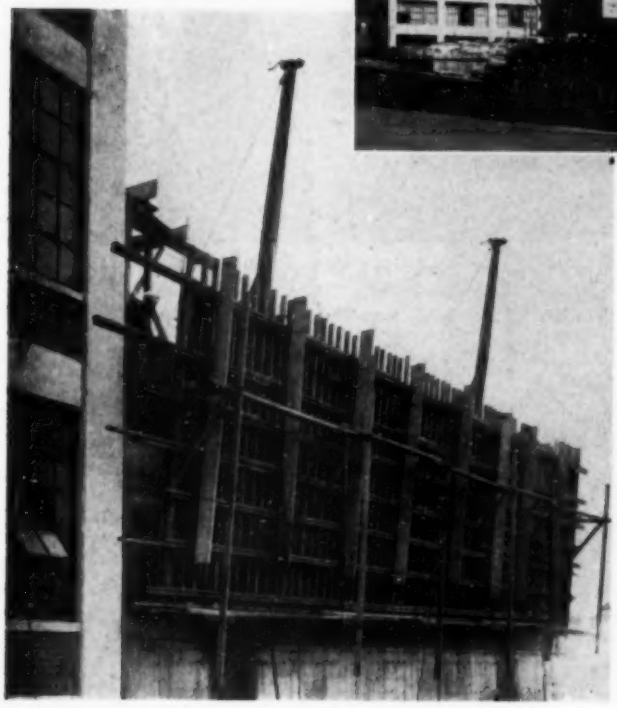
Near each end of the form panel, two 22-ft-high, 5-ton-capacity hand derricks are set up. Hoist cables are attached to eye-bolts on the panel so that the derricks can immediately carry the load. Bolts holding the panel in place are removed and the snap-ties broken. Workmen then pry the panel away from the outside surface of the wall with crowbars. To expedite this work, wooden wedges are simply dropped between the panel and the wall.

When the panel hangs free of the wall, the hand derricks hoist the panel up until its bottom edge is approximately 4 in. below the top of the finished section of wall. The panel is then fastened in place with $^5/_8$-in. bolts, as before. Derricks continue to carry the load of the panel until it can be secured by lean-to beams and later to the floor forms. It takes approximately one hour to set up and release a panel, one hour to hoist, and one hour to clamp and tighten the panel in its new position.

After the panel is cleaned and the rustication for the architectural finish repaired or replaced, reinforcing is placed, the inside form is erected, and the floor form is erected. Concrete

money

M. J. COLARUSSO
Project Superintendent
Walter Kidde Constructors, Inc.,
New York, N. Y.



Above:
Exterior view of construction for four-story addition to Prudential Life Insurance Building in Newark, N.J., shows external wall forms in place for next level. Concrete pouring tower at left has double hopper of $1^1/_2$-cu yd capacity from which buggies are filled.

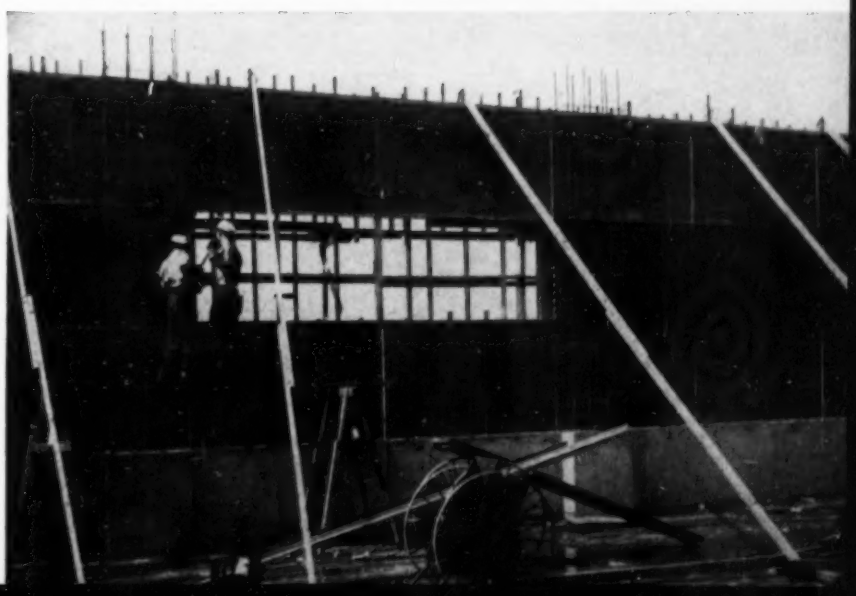
Left:
Form panel, 53 × 14 ft, is supported by two derricks while being pried loose from finished concrete building wall. About one hour is needed to set up and release form panel, one hour to hoist it to new position, and one hour to clamp and secure it in new position.

Below:
View of outer form panel from previously poured floor of addition shows rustication at right and space for window in center. Reinforcing rods for wall are being placed. Next, inner form will be set. Concrete will be poured in two separate operations: (1) 9 ft of wall up to next floor level, (2) floor above, plus first 3 ft 8 in. of wall for succeeding story.

is then poured for the 9-ft height of wall remaining to complete the wall below to the level of the floor above. The joint between the old and new pour for the wall is smoothed and grouted.

Floor reinforcing steel is then placed and concrete for the floor and the 3-ft 8-in.-high portion of the wall for the next story are poured. This completes a cycle of operations.

The contractor on this work was Walter Kidde Constructors, Inc., who won with a low bid of $336,000. The carpentry superintendent was Tomas Uldal, and the field engineer, Philip Vaderboncoeur. For the Prudential Life Insurance Co., John M. Infanger was project coordinator and Robert Kelso was the architect.



Cost of Detroit's urban expressway network is being met through broadened federal-aid policy plus annual payments by city, county and state, as well as $80,000,000 bond issue. In this air view looking east, Ford Expressway twists from right to left through Michigan Avenue Interchange area. Michigan Avenue can be clearly followed from center foreground to business district near the river at far right.

Detroit pushes expressway system through congested urban area

H. C. COONS, M. ASCE, Deputy Commissioner and Chief Engineer, Michigan State Highway Department, Lansing, Mich.

FIG. 1. Detroit is focal point of interstate highway system in Michigan. Now under construction is Edsel Ford Expressway to continue Detroit Industrial Expressway for east-west route through city. Also under construction is John C. Lodge Expressway, north-south route into city

Like many American cities, Detroit's urban area has long suffered from serious traffic congestion. Initiation of the Detroit expressway program dates back to the late 1930's when a thorough survey was made of street traffic in the city. This study, conducted in connection with the 1936 statewide highway planning survey, showed clearly that the city greatly needed an additional system of major arteries of expressway caliber.

Through the joint efforts of the City of Detroit, the Wayne County Road Commission, the Bureau of Public Roads, and the Michigan State Highway Department, a plan for a proposed system of expressways was formulated. The general locations, types of design, financing, and attendant problems were studied for many months. Data from the

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original study of street traffic and from subsequent special surveys proved that the first priorities should be given to two major routes.

The first of these major priorities was for an east-west route to remedy the existing lack of adequate cross-town arteries; it was planned as an industrial highway connecting the areas centering about the Ford River Rouge plants with the industrial districts in the Milwaukee Junction and Connors Creek sections. This route bypassed the central business district. The second major artery needed was a north-south route to relieve the tremendous daily traffic on Woodward Avenue and parallel streets; it would be a commuter facility connecting downtown Detroit with suburban areas to the north and northwest.

Before work could start on this program, World War II was upon us, and the efforts of all highway agencies were directed toward meeting its demands. The need for emergency action developed in the Detroit area some months before the country was involved in actual war. Early in 1941, announcement of the proposal to establish a giant Army bomber plant at Willow Run, near Ypsilanti, to be operated by the Ford Motor Car Co., posed problems of transportation which demanded immediate and adequate solution if efficient plane production was to be obtained.

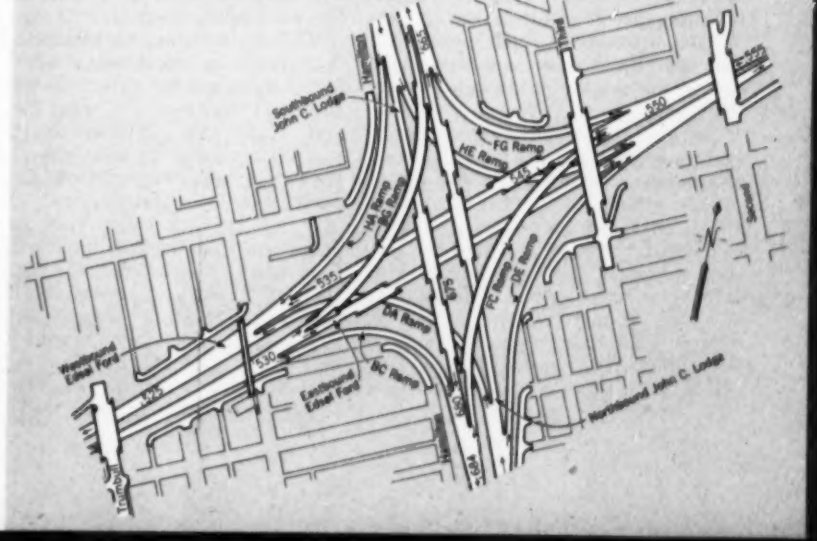
The plant, according to responsible Army and company officials, was to employ upwards of 50,000 workers, and its site in a rural area, 25 miles from the Detroit labor reservoir, required that employees commute from the city to the plant. In the absence of suitable rail facilities, transportation would have to be by highway, and the existing highways were already overloaded and provided no direct access to the Willow Run site.

A system of access roadways at Willow Run and the expressway connection to Detroit were designed and built to meet this emergency. The complicated problems of handling huge traffic volumes in the immediate area of the bomber plant were solved by means of a system of highways and structures which included two tri-level highway grade separations at the principal plant gates and spurs connecting with Ypsilanti, Ann Arbor, and existing nearby trunklines.

The problem of providing additional highway capacity between Willow Run and Detroit was solved by building the Detroit Industrial Expressway (Fig. 1). This was an

Detroit is solving its urban traffic problems by building six-lane expressways to serve heart of built-up area. Air view of interchange between Edsel Ford and John C. Lodge Expressway, looking north along the latter, shows ramps for direct traffic interchange under construction.

FIG. 2. Outstanding example of direct-connection interchange is that at intersection of Edsel Ford and John C. Lodge Expressways which covers approximately eight city blocks. Location is about 1½ mile north of Detroit's central business district.



Paving is seen under way near Warren Street on Lodge Expressway.

FIG. 3. Typical expressway section carries three lanes in each direction.

extension of the western section of the east-west industrial expressway, now known as the Edsel Ford, on which planning was in progress when the war emergency broke.

The Willow Run and Detroit Industrial Expressways were completed in time to make a vital contribution to the war effort by making available Detroit's assembly-line techniques in the manufacture of munitions. They also served as a testing laboratory for several innovations in expressway design which later were incorporated in the Detroit expressways.

Financing of expressways

Construction of the system serving Willow Run, and connecting it with the metropolis, was financed largely with federal funds appropriated for access highways required by the war. Financing of the Detroit expressway program, which was given immediate attention as soon as the war ended, was made possible by the Federal Highway Act of 1944 which extended federal aid to projects on streets in the larger cities.

To take the fullest advantage of this broadened federal-aid policy, the City of Detroit, the Wayne County Road Commission, and the State Highway Department took steps in 1946 to pool their resources. These three agencies entered into a tripartite agreement which prescribed the distribution of financial and engineering responsibilities among the three parties.

On the basis of federal funds absorbing one-half the costs of construction and one-third of the right-of-way expense, the agreement provided that the department would contribute one-half, and the city and county each one-quarter, of the monies required to match the federal aid, said monies to be disbursed on orders from the State Highway Commissioner. Annual expenditures of the three agencies were limited to $6,000,000, affording a yearly construction program of between 10 and 12 million dollars.

Overall engineering responsibility was assigned to the State Highway Department, for providing plans, securing rights-of-way, awarding contracts, and supervising construction. In actual practice, because of lack of personnel, the department drafted plans for the Edsel Ford Expressway and the huge interchange facilities at the intersection of the two arteries, while the Wayne County Road Commission, acting as agent of the department, drafted the plans for the Lodge Expressway. Project supervision and right-of-way acquisition are similarly divided. Plans for utility changes have been made by the pertinent municipal agencies. The theme throughout was cooperation.

New financing expedites program

These arrangements for engineering continue practically unchanged, but financing plans have been altered radically in order to accelerate the work. The pay-as-you-go basis on which construction was initiated would have required, if continued, at least 15 years for completion. The participating agencies agreed that this was much too long a period. To expedite progress on the program, a new plan of financing was adopted which, it was estimated, would complete the job in five years.

The key feature of the new plan was to borrow, by bond issue, sufficient funds to cover the entire portion of the costs borne by the city, county and state. To provide the legal means to issue bonds, the state legislature, in 1950, passed an act authorizing the state and local agencies, either separately or in cooperation, to undertake the construction and maintenance of limited-access highways, to negotiate loans and issue revenue bonds, and to dedicate anticipated income for amortization of the debt. Dedication of motor-vehicle revenues by the State Highway Commissioner for this purpose was first limited to $3,000,000 per annum. In 1950 it was raised to $5,000,000, and then in 1953 to $7,500,000.

Acting under this statute, the department, city, and county entered into a contract covering all phases of the expressway program. Sale of an $80,000,000 bond issue was authorized and negotiated. The department pledged a minimum annual payment of $2,500,000 and the city and county $1,250,000 each for debt service. Responsibility for all phases of the program continued on virtually the same basis as before.

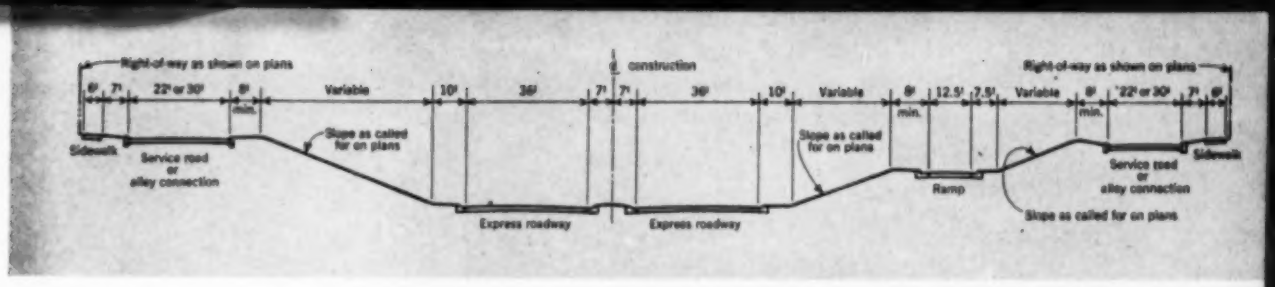
The Detroit expressway system being built under this financial plan will have an ultimate total length of approximately 23 miles. The length of the crosstown Edsel Ford Expressway will be about 14 miles, while the John C. Lodge Expressway will extend 9 miles northward from a point near the Detroit River. The estimated aggregate cost of both expressways is $190,000,000, of which approximately $70,000,000 has been expended to date, with an additional $30,000,000 encumbered.

Three designs studied

From the inception of the plan for the Detroit expressways, it was contemplated that they should constitute a system of limited-access highways superimposed on the existing street pattern. When actual design and planning began, much time and study were given to decide whether the new arteries should be built above, at, or below the existing street level.

It was contended that the elevated design would 'cause less disturbance of the present street pattern, would require a minimum right-of-way expenditure, and would simplify interchange problems. In opposition, it was argued that the elevated structures would create ribbons of blight throughout their length and would be very destructive to the existing pattern of land use.

It was found that surface expressways would be impractical and not economical in terms of overall cost, because they would require overpass or underpass structures at all major artery intersections and the closing off of all other intersecting streets.


Right-of-way as shown on plans
6' 7' 22' or 30' 8' min. Variable 10' 36' 7' 7' 36' 10' Variable 8' min. 12.5' 2.5' Variable 8' min. 22' or 30' 7' 6'
Right-of-way as shown on plans
Sidewalk
Service road or alley connection
Slope as called for on plans
Express roadway
Express roadway
Slope as called for on plans
Ramp
Service road or alley connection
Sidewalk
Slope as called for on plans

For depressed expressways, it was asserted that they would not cause blight on adjacent lands and that, if properly located along the borders of established land-use neighborhoods, they would create the least disturbance of the economic pattern. The heavy costs of right-of-way, construction, and utility rearrangement were argued against this type of design.

These several factors were carefully weighed by our engineering committee and, before a final decision was reached, expert opinion was solicited from a number of experienced city and transportation planning engineers. In the end, the balance of judgment favored the depressed type, and it was adopted.

In the design of the expressways, a principal objective was to obtain the highest possible capacity per lane. The use of completed parts of both routes proves that this objective has been successfully attained.

The expressways are depressed, not to exceed 18 ft, below the abutting street levels. They consist of two 36-ft roadways separated by a 14-ft curbed median, and 10-ft shoulders along the outside edge, which are provided for disabled cars. Except on ramps at interchange and access points, vertical and horizontal deviations of alignment have been held to a minimum.

Crossing structures are designed to permit the expressways to pass under or over them at full width, including shoulders and divider strips. On the Ford Expressway, grade separations were designed with slope spans at the end of the structures. However, the more restricted conditions along the Lodge route did not permit this economical design type, and the structure ends rest on deep abutments.

An important design feature, contributing to the ability of the Detroit expressways to handle large traffic volumes, is the principle of direct connection at interchanges. This feature was adopted from the expressways built to serve Willow Run for which this type of interchange was developed and where it proved its general efficiency.

Studies of the estimated traffic volumes on the Ford and Lodge routes indicated that the expected heavy traffic flow would be impeded in its peak periods by the turning maneuvers required on the conventional cloverleaf type of interchange. The direct-connection interchange does away with this confusion and so expedites the movement of heavy traffic because the roadways at transfer points are arranged to permit normal turning movement; in other words, the driver turns to the right or left in the actual direction of his route. Experience at Willow Run proved the ability of this type of interchange to move large traffic volumes smoothly and expeditiously. An outstanding example of this design principle and a major feature of the Lodge and Ford Expressways is the interchange system at the intersection of the two routes (Fig. 2).

Contracts completed and awarded

The work awarded to date on the Ford and Lodge Expressways entails the moving of some 3,400,000 cu yd of earth, all of which has so far been wasted, with an average haul to disposal areas of 6.3 miles. For subbase borrow, an additional 360,000 cu yd of granular material has been hauled an average of 9.4 miles. The amount of 10-in. reinforced concrete pavement thus far placed is 424,000 sq yd. In structures, 148,000 cu yd of concrete has been placed, as well as 15,600,000 lb of reinforcing steel and 42,150,000 lb of structural steel.

This work has been done by approximately 24 of our large and small contractors, under contracts ranging from $30,000 to $2,000,000.

Construction of the Detroit expressways was started early in 1947. Sections about 2.5 miles long on each expressway have been completed and are in service. In spite of difficult access conditions at the termini of the completed sections, the new arteries are attracting huge volumes of traffic and already are relieving congestion in the areas they serve. We hope to have the entire project in service by 1957.

The Division heads from the State Highway Department in Lansing, who have been responsible for the design and construction, are Carlos A. Weber, M. ASCE, assistant chief engineer; C. H. Cash, road engineer; H. J. Rathfoot, road construction engineer; P. E. Plambech, road design engineer; G. M. Foster, M. ASCE, now chief deputy commissioner and formerly bridge engineer; H. R. Puffer, bridge engineer; and E. S. Gleason, bridge design engineer. Field work has been supervised by C. H. Brown, metropolitan engineer; and Paul Ueberhorst, metropolitan bridge engineer. M. J. Huber, Harry Shuptrine, M. ASCE, and J. C. Mead, M. ASCE, represent the Wayne County Road Commission; and Glenn C. Richards, superintendent of public works for the City of Detroit, is the coordinator for the county, city, and state.

Construction progresses on interchange between Ford and Lodge Expressways, with its curved ramps (see Fig. 2).

Lodge Expressway has depressed roadways and other design features similar to those of Ford Expressway.

Forms for prestressed beam 29 ft long have near wall removed to disclose ordinary reinforcement and spiral tubes for high-strength prestressing bars, to be installed later. End walls are inclined so as to be perpendicular to direction of spiral tubes. Pipe nipples provide for injection of pressure grout. Movable sheds in background are for temporary protection of precast members.

Precast columns and beams form skeleton of three-story building 60 ft wide, as seen in view of east end, with existing Engineering Building at right. End bay is not typical as it has two intermediate columns instead of one, and precast cross beams and haunched wind struts on close spacing to provide for stairs and partitions. Two steel columns at left support steel roof truss because factory building on that side does not extend out to building line.

FRITZ KRAMRISCH, A.M. ASCE

Structural Engineer, Albert Kahn Associated Architects & Engineers Detroit, Mich.

Precast and prestressed members form skeleton of multi-story

When the Glenn L. Martin Company decided to expand the engineering office space in its plant at Middle River, Md., it chose to utilize an open court, 60 ft wide, between the existing Engineering Building and a part of its factory. This court provided ample room for the proposed 365-ft-long extension to the Engineering Building.

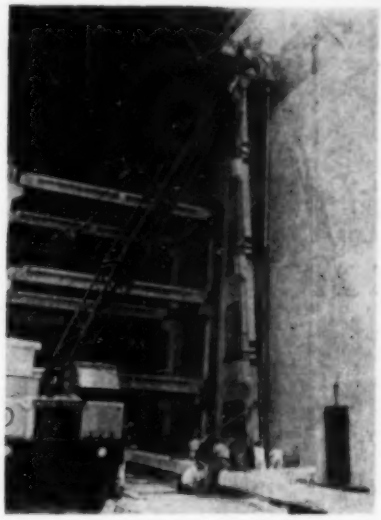
The existing Engineering Building is four stories high and consists of a reinforced concrete skeleton with cellular steel floors and exterior brick walls. It was connected with the new building over its whole length by removing the windows and intermediate walls.

To use concrete, poured in place, for the new building was considered objectionable because it would create considerable dust in the narrow court area and would make it difficult to meet the owner's restricted time schedule. And since structural steel was not readily available in sufficient quantity, the owner selected a design with a skeleton consisting entirely of precast and prestressed concrete members.

Except for the first bay at each end, the new building is supported crosswise by three rows of columns about 30 ft apart with an expansion joint on the factory side. (The first bay is supported by four rows of columns about 20 ft on centers.) Lengthwise, the building extends over 23 bays with a typical width of 16 ft. The building has three supported floors and a steel roof carried by trusses spanning the whole 60-ft width without intermediate support. To protect the ground from the spring rains and to make the rest of the erection work independent of unfavorable weather conditions, the steel roof was built first by supporting its trusses temporarily from the parapets of the adjacent existing buildings.

All building columns are of precast concrete construction, cast in one piece for the full height. They are of prismatic shape and of uniform size through all floors, with brackets projecting only in one plane for simple casting. Their extreme length is 49 ft and their minimum cross section 14 in. square. In most cases, the column is set in a concrete socket built on top of the footing or pier. Where the available depth was insufficient to provide for such a socket base, a steel base-plate with welded-on dowels was cast with the column shaft.

Except for the first bay at each end of the building, all three floors are supported by precast prestressed beams about 29 ft long, spaced 16 ft on centers. The beams are of I-section, enlarged at the ends to a solid anchor block. The minimum compressive strength of the concrete was specified as 4,000 psi at 28 days. The beams were post-tensioned by three high-strength prestressing bars of $1^1/_8$-in. diameter, laid in parabolic curves. Since the beams had to be cast before the arrival of the prestressing bars (which at that time had to be ordered from England), spiral tubes were embedded in the concrete with a dummy bar placed inside during the casting operation to increase their stiffness and prevent accidental buckling or blocking. After the tensioning of the bars had been completed, the remaining space within the tubes was filled with pressure grout.



Next to last wall column is being lowered by crane into socket base, while final column (on ground) is being fitted with steel ties. These two columns have four brackets because they support fan room in addition to three floors below. In background appear several rows of typical framing with prestressed beams. End bay will be specially framed as seen in another photo.

Above: Looking down from above third floor, observer sees typical construction of precast columns and prestressed beams, tied together by angles welded to anchor plates embedded in beams. Angles also will support steel flooring. Spaces at ends of beams will be filled with grout. Projecting tees are for connection of pipe struts, one of which is seen in place in foreground.

Right: Concrete-blocks are being placed for west wall of building. Note bolted-on steel ties between columns and beams, and bolts for connecting wind struts and cross beams in end bay.

office building

The first bay at each end of the building is used for stairs, toilets, and fan rooms. Since the typical column spacing and beam framing could not be adapted to the architectural requirements of these areas, ordinary precast beams of rectangular cross section were used instead. Intermediate cross beams had to be provided in these bays to support partitions and stairs.

All beams, whether prestressed or just precast, rest on brackets monolithically cast with the column shafts. A grout space was provided under each beam-seat to coordinate the elevation of the new beams with the floor elevations of the existing Engineering Building.

In the new building, cellular steel flooring is used for all supported floors and fan rooms. The typical units span 16 ft and are welded to steel strips provided on the top of all beams. These steel strips were secured to the cast beam sections by a cartridge-powered tool. The steel flooring is covered directly with plywood and linoleum tile, without the use of a concrete topping.

In a building constructed of single members without continuity, greater consideration has to be given to lateral stiffness than in a monolithically poured structure. In this building lateral stiffness was obtained by filling the erection clearances at the ends of each beam with grout to develop compression, and by providing metal connections capable of acting as ties. Welded connections were used for all prestressed beams. Anchor plates were embedded in the faces of the end blocks and angle ties were welded to them, to serve also as supports for the steel flooring at the column. Bolted tie connections were used for the ordinary precast beams in the end bays. The welded connections proved more practical because they required less accurate workmanship.

For longitudinal stiffness, the first bay at each end of the building was made rigid by providing cross beams with haunched ends (called haunched wind struts), welded at top and bottom to the columns. The interior bays of the building are held in the longitudinal direction by struts, some of which are precast members and some steel pipe sections.

Construction required about five months from start to first occupancy of some of the offices.

The building was constructed under the direction of Fred L. Wilcox, plant engineer for the owner, the Glenn L. Martin Company. The architect was Albert Kahn Associated Architects & Engineers of Detroit. Redding & Company, Inc., of Baltimore furnished the labor.

Offices were occupied in August 1953, about 5 months after construction started. Note ceiling of plastic panels completed over light tubes in foreground, but not in background.

Entrained air benefits lightweight-aggregate concrete

FRANCIS J. MARDULIER, Manager, Cement Mill Products, Dewey and Almy Chemical Co., Cambridge, Mass.

In normal-weight concrete the proper amount of entrained air is important. Too much may more than cancel out the benefits of improved placeability, impermeability, and durability which come with proper job control of entrained air in the concrete. This importance of controlled air in normal-weight concrete has led to two basic developments:

1. Building into the air-entraining agent a ceiling on its air-entraining potential.

2. Adding the air-entraining agent at the mixer, so that the amount added can be adjusted at the discretion of the field engineer or concrete technician in accordance with field conditions.

The first development was accomplished by combining two substances, one of which has limited air-entraining properties itself and also partially inhibits the air-entraining ability of the other, or principal, air-entraining agent.

That this air-entraining potential can actually be limited is shown by Fig. 1, which gives the percentage of entrained air in a standard concrete mix ($5^3/_4$ sacks per cu yd) in relation to the quantity of four different air-entraining agents used. These four agents were those found to be nonharmful under the early ASTM specification C 175-48T for air-entraining cement. With agents *A* and *C*, which are single-component saponified resins, the air content continues to rise as more air-entraining agent is added. On the other hand, with agents *B* and *D*, the amount of air that can be entrained is definitely limited. Agent *B* is basically a sulfonated hydrocarbon also containing a catalyst to improve the hydration of portland cement by water. Agent *D* is a saponified tall oil.

Under the conditions of the test, doubling the normal addition rate of agents *B* and *D* produced added air contents of a little over 6 percent. Use of either of these two air-entraining agents does not automatically guarantee correct air entrainment, of course, but it does provide a substantial safety factor. The inherent limit on the air-entraining potential of such agents as *B* and *D* can make them impractical for certain uses, particularly with lightweight aggregates.

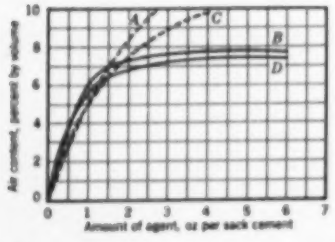


FIG. 1. Character of air-entraining agent used determines percentage of air in concrete. Here shown are test results using four different agents, *A*, *B*, *C*, and *D*. Agents *A* and *C* are saponified resins; *B* is a sulfonated hydrocarbon; *D*, a saponified tall oil.

Entrained air in lightweight concretes

Lightweight aggregates are generally manufactured by expanding clays, shales, slags, slates, micas, and pumices by firing or sintering the graded raw materials in kilns. Burning temperatures must be high enough to drive off the water of crystalization or other volatile constituents with near-explosive force, thus expanding the preheated semifluid mineral constituents, but temperatures must not be so high as to cause complete fusion. The resulting product usually looks like the clinkers removed from the ash pit of a coal-fired home furnace. Table I gives the physical properties of some of the commonly used lightweight aggregates, and of the concretes made from them.

Such clinkered materials make harsh and unworkable concretes. To offset this characteristic and facilitate placement, extra water must be added, far beyond that needed for chemical combination with the cement. This added water, the so-called "water of convenience," would be excessive with lightweight aggregate unless an air-entraining agent were added. Much of the mixing water is initially absorbed by the porous aggregate during the mixing process,

"Fatty" quality of properly mixed lightweight air-entraining concrete makes it easy to handle and place. Here Perlite concrete is being pumped into place on 350,000-sq ft building of North American Aviation Co. in Columbus, Ohio. Mix is 1:4, weighing about 39 lb per cu ft, with compressive strength in excess of 1,000 psi. Mixer and pump are Hoge type; air-entraining agent is Daralite.

and is released to a greater or lesser extent prior to initial set. This has the effect of diluting the cement paste, and thus of producing excessive water-cement ratios. Concretes of high water-cement ratio develop a wet consistency—instead of the desired fatty, plastic consistency—and tend to bleed and honeycomb badly during placement.

The properties of lightweight aggregate which produce harsh concrete also make it difficult to entrain air in the concrete. The angularity of the particles greatly decreases the number of bubbles which survive the mixing operation because the sharp points and edges tend to puncture the bubbles before they can be safely enclosed in the cement paste. Angularity also reduces the stability of the air bubbles after their formation, because the voids in such concretes are normally large, permitting the formation of large bubbles, which break down easily or migrate to the surface during the placing operation.

As a result, the controlled-air feature of agents such as *B* and *D* (Fig. 1) which make them preferred for use in regular concretes, makes them unusable in many lightweight-aggregate concretes. Cases have been known where agent *B*, even when added in very large quantities, fell short of developing enough entrained air to produce workable, low-bleeding concrete. This was not, however, attributable to any deficiency in the agent itself; rather it was a consequence of misapplication. Actually, for lightweight-aggregate concrete, the air-entraining agent must be designed for the specific type of aggregate used.

Agents *A* and *C*, although somewhat oversensitive for use with normal-weight concretes, are generally satisfactory with lightweight aggregates. When an exceptionally high air content is necessary, the large quantities of these air-entraining agents required, being organic, may cause delayed setting and low early strengths, particularly in cold-weather pouring. Under such conditions a quick acting air-entraining agent, which will require the addition of less total solids, by weight of cement, should be used.

More air with lightweight aggregate

Early in the development of air entrainment for concrete it was recognized that lightweight-aggregate concretes were benefited by air entrainment, even more than regular concretes. Cohesiveness and fattiness were tremendously improved. Bleeding and other forms of segregation, which were excessive without entrained air, were either eliminated or very greatly reduced; and homogeneity, compressive strength, and impermeability were substantially improved.

By substituting air for water, both of which are by definition fluids, actual water-cement ratios were markedly reduced, sometimes as much as 50 percent. With reduced water-cement ratios, and therefore higher air contents, the density of the cement paste was increased. Yet because air has no significant weight, the unit weight of the concrete was decreased and its insulating value increased.

The amount of entrained air required to produce the particular results desired depends upon the type of lightweight aggregate and the proposed use of the concrete. Extremely lightweight aggregates generally require the most air. Less air is desired in structural concrete than in insulating, fill-type concrete.

Further, the method of evaluating the end results is important. For example, if the criterion is maximum workability with minimum bleeding and unit weight, higher air contents are needed than when maximum strength and homogeneity are required. In the former case, the strength is somewhat lower, but the extra air substitutes for close grading control and also substitutes for cement. In the latter case, proper design and close job control of the coarse and fine aggregate grading are essential to satisfactory results. The extra attention pays off in an exceptionally good strength-density relationship.

With these variables in mind, it can be stated that the overall range of air contents for various types and classes of lightweight concretes is from about 7 percent to 30 percent by volume of the plastic concrete. This extreme range becomes more understandable if the air contents are subdivided for the types of concrete just mentioned. For structural-type concrete, air contents appear to range from 7 to 15 percent by volume of the plastic concrete. For the extremely lightweight insulating concretes, air contents

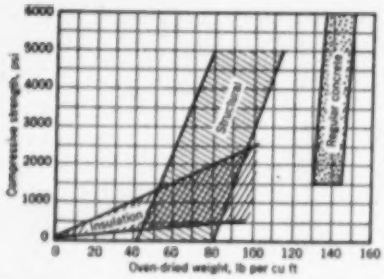


FIG. 2. Strength of lightweight concrete falls off as unit weight is reduced, and very fast for insulating-type concrete. Further work in zone of overlapping values on chart offers promise. Note that density of regular concrete is about 145 lb per cu ft.

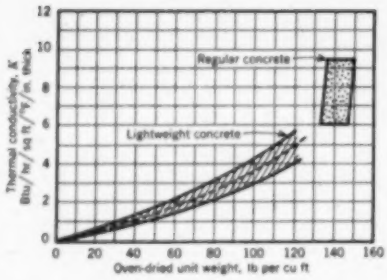


FIG. 3. Insulating value of lightweight concrete improves as unit weight decreases. Thermal conductivity, k, of regular (145-lb per cu ft) concrete is 6 to 9.

range from 15 to 30 percent by volume of the plastic concrete.

Lightweight insulating concretes are generally made from rather friable aggregates having a relatively small maximum size. For example, in perlite and vermiculite concretes, few particles larger than $^1/_4$ in. in diameter occur. Such concretes are essentially mortars. In view of the fact that the permissible air content for standard-weight concrete mortar is 18 percent ± 3 percent, according to ASTM specification C 175-52 T, air contents of 15 to 30 percent for concretes of the insulating type do not appear excessive. A mortar air content of 18 percent by this method is equivalent to about 4 or 5 percent entrained air in a 6 to $6^1/_2$-lb sack of concrete having a sand fineness modulus of 2.75 (approximate) and a maximum coarse-aggregate size of $1^1/_2$ in. The present tendency toward using higher air contents with these relatively harsh and angular lightweight aggregates is merely an extension of the same trend for normal-weight concretes.

The air content of the mortar for structural-type lightweight concretes with maximum-size aggregate of $^1/_2$ to 1-in. diameter can be calculated on an absolute-volume basis to be 10 to 22 percent of the plastic concrete, or an average of 16 percent. With $^3/_4$-in. top-size expanded clay aggregate, twice the normal amount of fine aggregate (equivalent to sand) is necessary for best grading. Thus there is roughly twice as much mortar having approximately the same air content as the mortar for normal-weight concrete. Overall, the concrete with $^3/_4$-in. aggregate has an air content of 7 to 8 percent by volume, which under the circumstances is practically normal, and not excessive even for regular concrete.

Most lightweight aggregates are inhibitors of air entrainment, definitely much more so than portland cement. Although the amount of air-entraining agent in normal-weight concrete is usually based on the quantity of cement, that is, $^3/_4$ fluid ounce per bag of cement, for lightweight concrete it would probably be better to proportion it on the basis of the aggregate content, and preferably the fine aggregate content. For example, for a perlite concrete, the proportion might be 1 pint per bag of perlite.

Recognition of this important point has been obscured by the difficulties of measuring air entrainment in lightweight concrete on the job. As a result it is usual to find much more air in rich lightweight concrete mixes than in lean.

Air content measured

The foregoing conclusions regarding the air content of lightweight concretes are based largely on observed yields in the field. Such observations are always necessary because the usual methods of determining air content, as employed with normal-weight concretes, do not work consistently with lightweight aggregates. For example, the pressure method, which is based on the premise that entrained air is the only compressible constituent present in the concrete, fails completely when applied to lightweight concretes.

The most practical and least laborious method is to compare job unit weights with and without the air-entraining agent. By so doing, the added air content is established, and not the total air content. A suitable correction must of course be made for the lower water content of the air-entraining concrete in such a comparison.

Further, if the entrapped air content of the non-air-entraining concrete is ignored, higher green shrinkage for the lightweight concretes may be approximately compensated for in the calculation of hardened concrete yields. Obviously the stability of the entrained air bubbles is also a factor here, so that complete compensation cannot always be assured.

Mixing sequence important

The "best" batching sequence and mixing procedure for lightweight concrete means the best procedure with the type of aggregate to be used. Another controlling factor is whether air entrainment is involved. For non-air-entraining concrete, the high absorption of the lightweight aggregate requires that the mixing water and dry aggregate be added initially and mixed, so as to partially saturate the aggregate first. The cement should then be added. Additional water may be added to secure proper consistency either at the mixer or at the placing point.

For air-entraining concretes, other factors are involved. An air-entraining agent works by reducing the surface tension of the liquid phase. Clearly then, this agent must be mixed with the water. Further, the cementitious gel formed by the hydrating cement becomes part of the liquid phase, and has a marked effect on the pH. There is less selective adsorption of the air-entraining agent by portland cement than by most of the lightweight aggregates. Hence the cement slurrying procedure is preferred, that is, the cement should be added to the mixing water in which the air-entraining agent is already dispersed, and the aggregate should be added last, slowly and separately if possible.

In air-entraining concretes, particularly those containing large percentages of entrained air, the air as a fluid substitute for water is essential to proper placement and consolidation. However, entrained air develops more slowly in concrete when it is in a "dry" condition than when it is plastic. In particularly obstinate cases, entrained air will not develop at all while the concrete is in a "dry" condition. However, by using the cement slurrying procedure described above, and by adding the aggregate slowly enough so that the plasticity of the slurry is never

destroyed, the air content will be built up rapidly, the mixing time will be held to a minimum, and aggregate-particle breakdown will be reduced.

Structural and insulating concrete

Strength of lightweight concrete varies considerably with the type of aggregate used, the air content, and the cement content. Even with a given type of aggregate, there is a wide variation in strength for a given unit weight. This is shown in Fig. 2. The variation is due not only to differences in the bulk specific gravity of the aggregate but also to variations in surface characteristics, resulting in differences in harshness and water requirements.

It will be noted that there is a definite trend in the relationship between oven-dried unit weight and compressive strength for the two general classes of lightweight concrete—structural and insulating. It is apparent that for only a slight reduction in the unit weight of the structural concrete there is a disproportionately large reduction in strength. The converse is true of the insulating fill-type concrete, also shown in Fig. 2. The zone of overlapping values between the insulating and structural concretes offers considerable promise for future work on combinations of very lightweight and medium lightweight aggregates. The best investment in structural lightweight concrete would appear to be a product in the 100-lb per cu ft range.

There is a definite relationship between oven-dried unit weight and insulating value, the *k* factor (Fig. 3). Because of the strength considerations already mentioned, there is little practical value in trying to use structural lightweight concrete for insulating purposes. Lightweight concretes of the insulating type give excellent insulation values in their normal working range, and a sizable improvement in insulating value is obtained for only a minor reduction in strength. Currently, interesting *k* factor-to-strength ratios are being obtained with mixtures of perlite and natural sand, as shown in Table I.

In conclusion, it should be emphasized that the amount of air purposefully entrained in concrete by an air-entraining agent should not be inflexible. It depends on the use for which the concrete is designed and on the character of the aggregates selected.

(The author of this article also prepared Darex AEA Bulletin No. 9 of the Dewey and Almy Chemical Co., which treats this subject in a similar manner.)

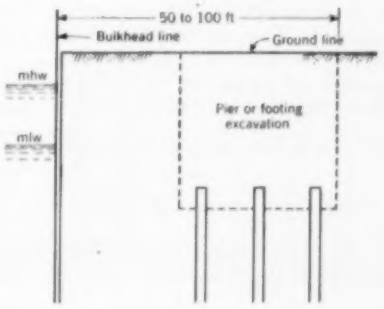
TABLE I. Physical properties of air-entraining lightweight-aggregate concretes

Item	Expanded Clay, Shale, Slate (e.g. Haydite, Lelite)	Expanded Slag (e.g. Waylite)	Expanded Perlite	Vermiculite	Mixture of Sand and Perlite
Use	Structural, but some insulating	Structural, but some insulating	Insulating, but some structural	Insulating	Insulating plus structural
Unit weight, lb per cu ft	80–115	75–100	21.5–50	25–50	50–80
Compressive strength, 28-day, psi	1,000–5,000, as high as 7,000 with some aggs.	500–3,500, depending on cement content	125–1,500 psi	100–700 psi	400–2,000 psi
Cement content	0–35% more than regular concrete	50–100% more than regular concrete	3–8 sacks per cu yd	3.5–9.5 sacks per cu yd	5.5–8.0 sacks per cu yd
Water content, gal per cu yd	50–60	55–70	50–60	85–95	45–60
Modulus of elasticity, % of regular concrete	25–95%	20–75%	3–10%	3–6%	.....
Insulation, *k*	1.5–4.5	1.5–3.0	0.6–1.8	1.0–1.8	1.0–1.2
Drying shrinkage	About same as regular concrete	Moderate for 2,000 psi and more. Leaner concretes shrink too much for structural use	May be too much for structural but O.K. for insulating concrete	Too much for structural but O.K. for insulating	Moderate O.K. for structural and floor topping
Range of air content, % of volume	7 to 15%	7 to 15%	15–30%	5 to 10%	10–20%

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those which deal with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor.—H. J. Gilkey

On a rush job, an engineer ordered untreated timber foundation piles for the support of a heavy foundation situated only 50 to 100 ft from a tidewater bulkhead line. The engineer designed the pile cut-offs well below mean low water knowing that wood piles below the water table are permanent. However, when the contractor excavated to a point several feet below mean low water for the footing, the pit remained dry to his dismay. It was too late to order pressure-creosoted wood piles. How would you protect these air-exposed timber piles from decay? For solution, see page 100.



Editor's Note: This is the twentieth in a series which started in the February 1952 Civil Engineering. In the April 1952 issue an article, "The Unexpected in Engineering: The Bugs," explains the project and enlarges upon the central theme that problems of the past created the practice of the present; that "The engineering of today rests upon a coral reef; sturdy remnants of yesterday's bugs." The process is a continuing one; there will always be today's and tomorrow's bugs to add zest and gray hairs to the practice of a profession that by its very nature must cantilever from a codified past to an untried future. "Long live bugs" is an ever-present challenge to the virility and ingenuity of the engineer. If you have a good bug, why not share it? H. J. G.

The above problem was submitted by Ralph H. Mann, M. ASCE, New York, N.Y.

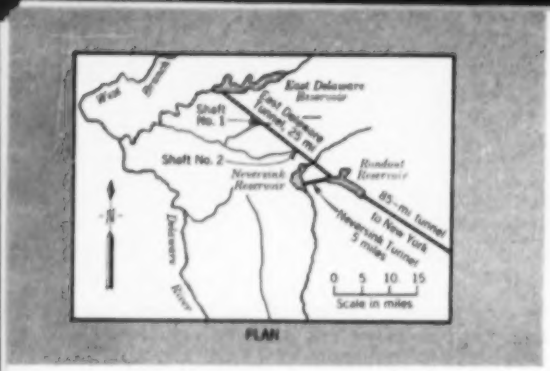


FIG. 1. Tunnel was driven and concreted from portals and both ways from two shafts. Shaft No. 1, on Beaverkill, is 610 ft deep, and Shaft No. 2, on Willowemoc, is 965 ft deep. Difference in elevation between two ends of tunnel is 300 ft.

East Delaware Tunnel construction to

The East Delaware Tunnel, built for the Board of Water Supply of the City of New York, was started August 3, 1949, and concreting is scheduled to be completed in January 1954, six months ahead of contract requirements. It is 25.5 miles long and has a finished diameter of 11 ft 4 in. It starts at a point in Pepacton, N.Y., on the East Branch of the Delaware River, and will deliver its water into the Rondout Reservoir at Lower Corners, N.Y. See Fig. 1.

Before entering this reservoir, the water will pass through turbines generating electric power. There is approximately a 300-ft difference in elevation between the two ends of the tunnel, and there will be an average flow of 335 mgd. See "Delaware Aqueduct to Increase New York's Water Supply 50 Percent," by Roger W. Armstrong, M. ASCE (CIVIL ENGINEERING, February 1949); and "New York's Delaware Aqueduct Develops Hydroelectric Power," by George R. Rich, M. ASCE (*ibid.*, December 1951).

The tunnel work was carried on at six points—two portals and two shafts, tunneling operations progressing both ways from each of the shafts. Shaft No. 1 on the Beaverkill River was 610 ft deep, and Shaft No. 2 on the Willowemoc was 965 ft deep. At some points, the tunnel was 1,700 ft below the surface of the ground. Each tunnel heading was driven at an approximate rate of 200 ft per week and the tunnel was finally holed through March 11, 1953.

The tunnel was driven through the Catskill series of shales and sandstones, both gray and red, the various strata being approximately horizontal. Several streams cross the tunnel line, and in practically every case a fault zone was found with water-bearing seams. At times, some menthane gas was encountered. With adequate ventilation no serious trouble resulted and the gas pockets bled out.

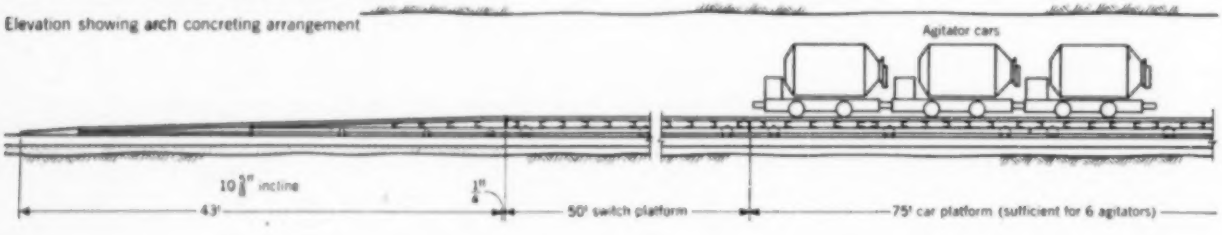
The shafts were sunk with temporary headframes using diesel generators for power. Later a long power line was installed to bring commercial power to the sites. After the commercial power was delivered, the diesel generators were used as standbys in case of a power-line failure. Generally, one round a day was shot at the end of the day shift and enough muck was made to last through the other two shifts. Gardner-Denver jackhammers were used for drilling with Carboloy bits.

The shafts were concreted in 30- to 50-ft sections as they were sunk, depending on the quality of the rock. Blaw-Knox steel forms of 14-in. diameter were used. The shafts had to be enlarged at the bottom to provide switching room for handling the heavy tunnel equipment. This work was done with shaft equipment; Ehmco muckers were used until the tunnel headings were far enough advanced to permit the installation of the permanent guides and headframes.

The headframes handled the cage, with its suspended muck skip, which automatically dumped into a hopper on the surface. At shaft No. 1 the headframe had an 8-cu yd skip and at shaft No. 2 a 16-cu yd skip. The whole load was hoisted at 750 fpm on a single cable. At shaft No. 1 the cable had a diameter of $1^{5}/_{8}$ in., and shaft No. 2 its diameter was $2^{1}/_{8}$ in. Both cages were counterweighted.

Drilling at the tunnel heading was from a jumbo with six Gardner-Denver $3^{1}/_{2}$- and 4-in. drifters mounted on hydraulic jibs. Detachable bits with Carboloy inserts were used. The contractor shanked and

FIG. 3. Concrete for arch pour is delivered in agitator cars to Pressweld gun. Car platform (center) has double track permitting empties to be passed around full cars waiting to be dumped. All concrete is batched on surface and dropped down vertical shafts into hoppers and thence into agitator cars. At right are Blaw-Knox telescopic arch forms.



J. S. MACDONALD, M. ASCE

Vice President

Walsh Construction Company

New York, N.Y.

be completed six months ahead of time

threaded his own drill rods at a central shop. Mucking was done with Conway 100 muckers. Where conditions were good, a round of 7 to 8 ft could be drilled, shot, and mucked in four hours.

Muck was hauled in 6.6-cu yd steel dump cars by mine locomotives made by the General Electric and Goodman Manufacturing Co. In the long headings, a trolley was installed from which the locomotive batteries were trickle charged. The muck was dumped through a hopper at the shaft bottom into the skip and hoisted to the surface.

Practically the whole length of the tunnel was supported. Because of the length of the headings, some of which were over 30,000 ft long, it was impossible to have a continuous scaling inspection done. At the start of the job, the conventional arch-rib type of support was used, which required an average of about 350 lb of steel per ft of tunnel. Finally, however, the suspension type of roof support was adopted, requiring about 50 lb of steel per foot of tunnel (see Fig. 2).

This method involved the use of 6-ft bolts of $^{29}/_{32}$-in. rivet steel, manufactured by Bethlehem Steel Co. with a slot in the upper end in which a steel wedge was placed. The hole was drilled to the correct depth, and 6-in. channels or Bethlehem mine-tie sections were used as washers. The bolts were driven home by a Stoper drill fitted with a special socket causing the wedge to expand the bolt and anchor it in the hole. Then the nut was tightened with an impact wrench thus binding the rock strata together and forming a 16-ft beam across the top of the tunnel.

A torque wrench was used to test the bolts to make sure that they had been driven home and tightened properly. Tests showed that up to 32,000 lb could be placed on one bolt before there was any movement. Finally, the roof was gunited to seal any small cracks. After these mine bolts were used there was practically no trouble with rock falling from the roof.

Bedrock grouted

Several stretches of bad rock were found and required considerable grouting to stop flows of water. We used a Gardner-Denver air-operated pump capable of producing 1,000-psi pressure. Sectional drill steel was used with a drifter to drill test holes at times as long as 45 ft. At one place at the south end of the job, it was necessary to place a concrete bulkhead. At another place, where there was a flow of 600 gpm, a concrete mat was placed in the invert. The flow was allowed to run into the discharge pipe and was under enough pressure to make the use of a pump unnecessary. It was finally sealed off by high-pressure grouting after the permanent concrete lining had been placed and cured.

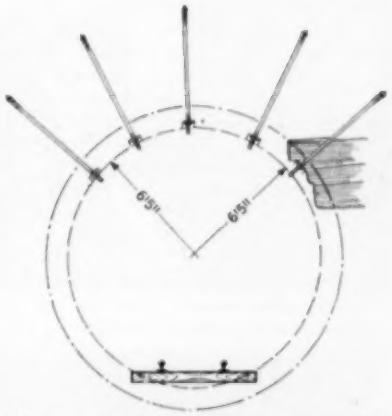
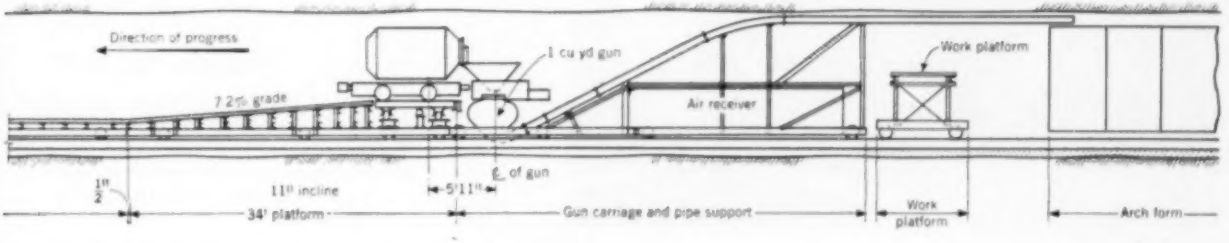


FIG. 2. Tunnel roof ties consist of 6-ft bolts of 29/32-in. rivet steel. Bolts have slotted end which is expanded by wedge when bolt is driven home by Stoper drill. As washers, Bethlehem mine-tie sections or 6-in. channels were used.



Ventilation in these long headings was quite a problem. The usual method is to exhaust after a blast to remove the gasses caused by the explosion and then to blow in fresh air. This method would not work in the long headings, however, as the blasting cycle was so short, that the air would only have moved back and forth in the tunnel, and would not have been removed. Therefore we adopted the continuous exhaust system by which a current of fresh air is carried down the shaft or into the portal, and then up to the heading. The exhaust pipe was never over 100 ft from the heading. An air mover operated by the high air was used to keep the air in the heading moving back to the exhaust pipe. With this system, very little time was lost clearing out the smoke after a shot. Root-Connersville blowers were used, and a 26-in. spiral-weld vent pipe was carried in the roof.

All the loose material had to be removed before invert concrete could be poured. A D-4 Caterpillar bulldozer electrically operated was used to plow the heavy material to the Conway mucker, which loaded it into dump cars. A 2-in. blow-pipe cleaned up the rest. A "covered-wagon" was used to keep the dust and mud from hitting the roof, which had already been washed.

Tunnel concrete was placed in three operations. The curb was poured first, usually while the excavation was in progress. This gave us a track for the cleanup and invert traveler. The invert traveler was about 1,000 ft long—long enough so that, as soon as it was moved, rail could be laid on the finished invert. This traveler started at the portal or shaft and worked away from it. A power screed was used which ran on the radial form and was bolted to the curb with Richmond anchors, placed as the curb was concreted. Richmond anchors, to bolt down the bottom of the arch form, were set in the invert as it was concreted.

The Blaw-Knox arch form was about 400 ft long and was telescopic. The traveler moved 30 ft of form at a time with hydraulic jacks. The concrete was placed with a 1-cu yd Pressweld pneumatic concrete placer. There were tapped holes in the steel form for grout pipes, which were placed during the concreting operation. Vent pipes were placed at high points in the rock roof to make sure these areas were completely filled with concrete, leaving no voids caused by air pockets. Placing of arch concrete is illustrated in Fig. 3.

We were fortunate in having a good source of aggregates all along the route. Some of the sites were on City property and some had to be acquired by the contractor. Crushing, screening, and washing plants were installed, and the aggregates were produced practically at the site of the work. At the portals, aggregates were conveyed or crane-loaded into the hoppers and batched and mixed in 2-cu yd mixers. Concrete was loaded into 4-cu yd Blaw-Knox agitators on flat cars and hauled into the tunnel, where it was agitated again and dumped into the forms.

At shaft locations, the batching and screening plant was set up at the top of the shaft. The mixed concrete was dropped down a vertical 10-in. pipe into a hopper at the bottom, loaded into agitators, and then hauled to the forms.

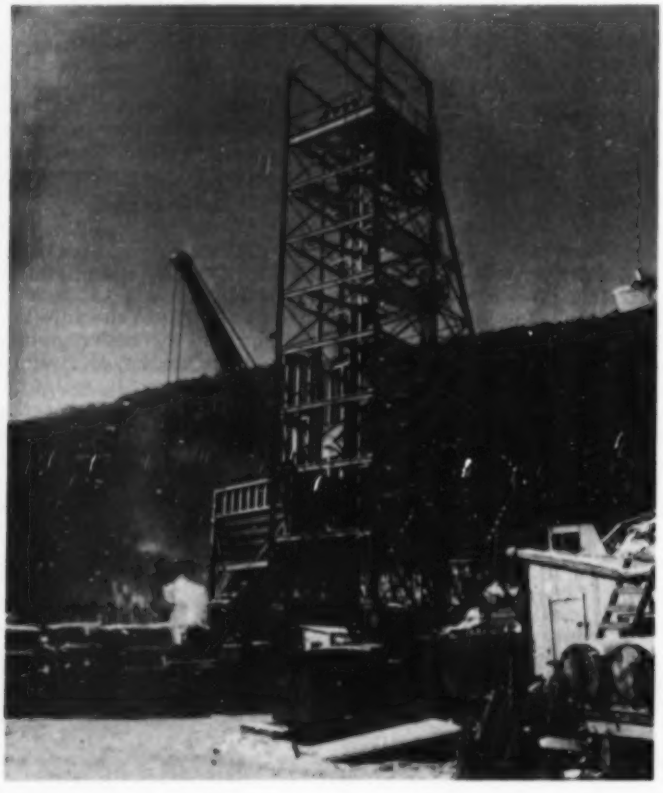
After the concreting was finished, and had set for 30 days, all the voids back of the lining were filled with a 1:1 sand and cement grout at low pressure—not over 100 psi. This grout was allowed to set, and the pipes were then drilled out and neat cement grout forced in under 500-psi pressure to fill the seams in the rock surrounding the tunnel. The grout was placed with a Gardner-Denver pump. In wet sections, additional holes were drilled.

In all concrete and grouting operations, Merriman-type cement was used (about 2 bbl to 1 cu yd of concrete) with excellent results. Concreting is scheduled to be finished in January 1954, and the work should be entirely finished by mid summer. The contract price for the work was $11,224,000.

For the New York City Board of Water Supply, the following are in charge: Irving V. A. Huie, M. ASCE, president; Karl R. Kennison, M. ASCE, chief engineer, succeeding the late J. M. Fitzgerald, M. ASCE; and Leroy Hammond, deputy chief engineer.

For the Walsh Construction Co. and B. Perini & Sons, the writer is in general charge; Charles F. Kelly is project manager; Clyde Turner, general superintendent; and Albert Allio, job engineer.

Headframe handles counterweighted cage, with suspended muck skip. This skip automatically dumps into hopper seen at left of frame. Load is hoisted at 750 fpm on single cable.



FIELD HINTS

Column encasement placed by pumping method

Economy of placing method lies in minimizing amount of rubbing and patching, elimination of ramps to upper floors, and elimination of need for vibrating forms. Pumping machine can place encasement for 10 to 12 columns per day.

Mixing truck dumps 3 cu ft of concrete made with pea-gravel aggregate into pumping machine. Machine shoots concrete into column encasement forms by compressed air. Columns 28 ft high have been encased by this method.

A novel and economical method of placing concrete fireproofing around steel columns has been successfully pioneered by the contractor on the Atomic Energy Commission's project at Paducah, Ky. The method involves the use of a small, 3-cu ft grouting machine which shoots the concrete into the column forms through a $2^1/_2$-in. flexible hose under compressed air. The grouting machines are loaded directly from the mixing trucks. Columns up to 28 ft high have been encased in this way.

F. H. McGraw and Company, prime contractors on the Paducah job, report that one machine will pump the concrete encasement for 10 to 12 columns per day, and that forms are reused to the same extent as when normal placing methods are employed. Savings have been realized by eliminating runways since all concrete is placed from the first floor, and by eliminating the need for vibrating the concrete into place. It is further reported that rubbing and patching of the surface has been reduced to a minimum.

The special grouting machine has been developed by the Ballard Machinery Co. of New York.

ENGINEERS' NOTEBOOK

Simple models help students to visualize Maxwell's theorem

ANTHONY HOADLEY, M. ASCE

Professor of Civil Engineering

Union College, Schnectady, N. Y.

The models here illustrated were developed to show the meaning of Maxwell's theorem of reciprocal deflections and its use in obtaining influence lines for indeterminate structures. The line diagrams were drawn in India ink on white paper. This was then laminated with a white plastic making a stiff board $^3/_8 \times 22 \times 40$ in.

Senior civil engineering students at Union College study these models before taking up laboratory work, which gives them a brief introduction to the use of splines or wires to obtain influence lines for beams and to the use of Beggs' deformeters for finding the reactions of indeterminate structures. The photographs were taken by Walter Mathias, instructor in mechanical engineering.

Before these models were developed we went through a mathematical

derivation of Maxwell's theorem and then students were given a few hours of work on the use of Beggs' deformeter gages, as applied to rectangular frames. The fact that the deflections produced in the model cannot be seen except by use of a microscope often left students in a rather confused state of mind. This led to the development of models in which very large deflections are used and also to the use of a brass beam (Figs. 1 and 2) carrying a load so that the students could get the relationship between the deflection of this real beam and the influence line for the reaction on a similar beam. The students have been required to determine reaction influence lines by the use of simple wires or splines (Figs. 3 and 4) and to develop influence lines for the reactions of a rectangular frame using the Beggs' deformeter. The students found the moment influence lines of Fig. 4 very helpful in the design of a continuous girder for a traveling crane.

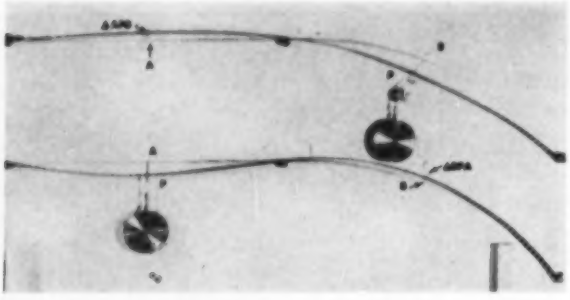


FIG. 1. Beams represented by brass bars show reciprocal deflection relationship between two points on a beam which was developed by James Clark Maxwell in 1864. Each brass bar is $\frac{1}{16} \times \frac{3}{4}$ in. in cross section and about 40 in. long. It is hinged at right end and carried on roller supports at middle and left end. Model emphasizes fact that reciprocal relationship applies to beams of any shape and that applied loads do not have to be vertical. Students can easily see that deflection at A, due to load P acting at B, is equal to deflection at B due to same load at A, deflection being measured in direction of load in each case.

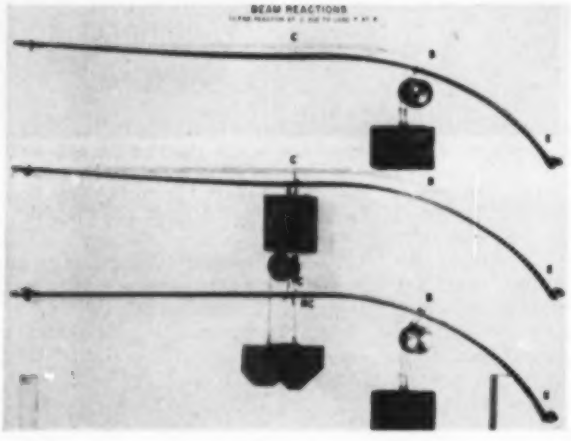


FIG. 2. Beams represented by brass bars solve problem of finding reaction at C due to load P at B. Beam I is loaded at B with no support at C, causing deflection ΔCPB at C. Reaction at C is that force which will cause upward deflection of ΔCPB at C, thus returning C to its original position. Beam II is loaded at C with supports at ends only, causing deflections ΔCPC and ΔBPC. As deflection is proportional to load, reaction at C in beam supported at D, C, and E would be $R_c = P \times \Delta CPB/\Delta CPC$. Maxwell's theorem shows that deflection curve II is influence line for reaction at point C. Beam III carries load P at B, and reaction at C, which is $R_c = P \times \Delta BPC/\Delta CPC$. Reaction at C due to load P at any other point, F, will be $P \times \Delta FPC \div \Delta CPC$, where ΔFPC is ordinate measured to deflection curve here shown in II. When load is adjusted so that $\Delta CPC = 1$, deflection curve becomes influence line for R_c. Ratio $\Delta BPC \div \Delta CPC$ is independent of size of P.

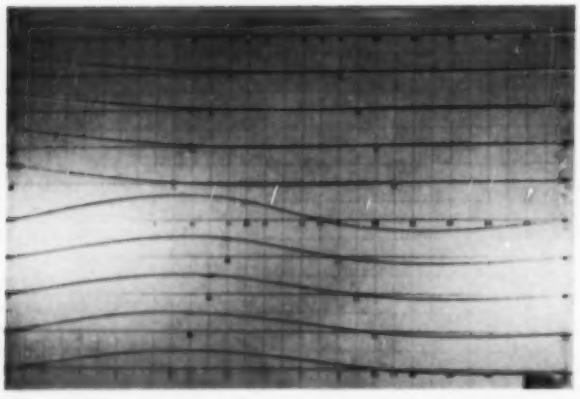


FIG. 3. Influence lines for reactions at end and first interior support of a three-span continuous beam with variable spans are shown by steel splines 0.022 × 0.250 in., used with 1-in. deflection at point of support.

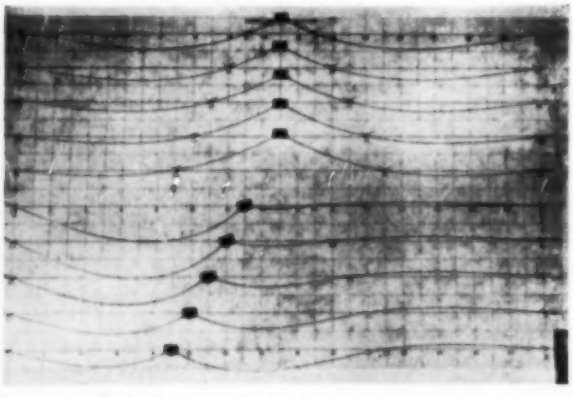


FIG. 4. Influence lines for moment at center of beams and at first interior support of a three-span beam with variable spans are shown by steel wires 0.032 in. in diameter. They are turned through angle of one radian at moment point.

AMERICAN SOCIETY OF CIVIL ENGINEERS

ATLANTA CONVENTION

Atlanta Biltmore Hotel Atlanta, Ga. February 17–19, 1954

SPONSORED BY THE GEORGIA SECTION

REGISTRATION

Atlanta Biltmore Hotel Crystal Lounge

Hours: Sunday, February 14, 3:00 to 6:00 p.m. Monday through Friday, February 15–19, 9:00 a.m. to 5:00 p.m.

Registration fee, $3.00. (No fee for ladies and students.)

Includes tickets for Wednesday Icebreaker Party and Ladies Tour Wednesday for all registered.

ADVANCE ATTENDANCE INFORMATION

To assure adequate preparation to make your attendance at the Atlanta Convention most satisfactory, the Committee requests your assistance.

It is most helpful to have guidance in the number of persons to be expected for various functions. Will you please use the coupon on page 103, sending this to HAROLD J. SPAEDER, Registration Chairman?

There is no obligation attached to your use of this coupon. It is a new procedure being tested by this Committee. It can be very helpful, with your cooperation. If you wish, you may send your check to cover the registration fee and tickets reserved. However, this is not necessary.

LOCAL SECTIONS CONFERENCE

Monday, Feb. 15 Tuesday, Feb. 16

Atlanta Biltmore Hotel Room 14

Representatives of Local Sections, Branches and Subsections of ASCE in the Southeast will convene to discuss the expanding activities of the Society at the local level. This conference, which is primarily for invited delegates of selected groups, will be open to any and all who may be interested in the activities and operational details of ASCE Sections.

AUTHORS' BREAKFASTS

Wednesday–Friday, Feb. 17–19

8:00 a.m. Mezzanine Writing Room

Presiding: C. P. Lindner, Chairman, Technical Program Committee

Briefing sessions for all speakers and program officials by invitation.

GENERAL BUSINESS MEETING OF THE SOCIETY

Wednesday, Feb. 17

9:00 a.m. Ballroom

Presiding: Daniel V. Terrell, President, ASCE

WEDNESDAY MORNING FEB. 17

Welcome Session

Ballroom

Presiding: Moses E. Cox, General Chairman, Atlanta Convention Committee

9:30 Welcome by Georgia Section
C. E. DRUMMOND, President, Georgia Section.

9:35 Welcome by City of Atlanta
HON. WILLIAM B. HARTSFIELD, Mayor.

9:47 Response
DANIEL V. TERRELL, President, ASCE.

GENERAL SESSION

Ballroom

Sponsored by Committee on Conditions of Practice

Presiding: G. Brooks Earnest, Zone III, Vice President, ASCE, Chairman, Committee on Conditions of Practice

9:55 The History, Development and Objectives of the Committee on Conditions of Practice
G. BROOKS EARNEST

10:25 Engineering Education
L. E. GRINTER, M. ASCE; President, American Society for Engineering Education.

10:55 Engineering Registration
ALAN G. STANFORD, Past President, National Council of State Boards of Engineering Examiners.

11:25 Employment Conditions and Salaries
JAMES I. BALLARD, Chairman, ASCE Committee on Employment Conditions.

12:00 Adjournment for Welcoming Luncheon

WELCOMING LUNCHEON

Wednesday, Feb. 17

12:30 p.m. Exhibition Hall

Presiding:
C. E. DRUMMOND, President, Georgia Section.

Address: Engineers and Their Public Responsibility
Hon. HERMAN E. TALMADGE, Governor of Georgia.

MOSES E. COX, Atlanta Convention Chairman, will introduce the Governor. All members, their ladies and guests, and friends of ASCE are cordially invited.

Price $2.00 per plate. Tickets for this event must be purchased before 10:00 a.m. on Wednesday.

WEDNESDAY AFTERNOON

Feb. 17

The following Divisions will hold technical sessions Wednesday afternoon: City Planning, Power, Sanitary Engineering, Structural.

CITY PLANNING DIVISION

2:00 p.m. **Room 10**

Presiding: Harry W. Alexander, Member, Executive Committee, City Planning Division

2:00 **Planning Approach in a Small City**
V. T. WICKHAM, Personnel Director, Service Division, West Point Manufacturing Co., Langdale, Ala.

3:00 **Training of City Planners at Georgia Inst. of Tech.**
HOWARD K. MENHINICK, Regents Professor of City Planning, School of Architecture, Georgia Institute of Technology, Atlanta, Ga.

Power Division

2:00 p.m. **Room 14**

Presiding: E. S. Harrison, Member, Executive Committee, Power Division

2:00 **Civil Engineering Features of Delta Steam Plants**
GEORGE E. ARCHIBALD, A.M. ASCE; Engineer, Ebasco Services, Inc., New York, N.Y.

Discussion

2:45 **Coal Handling Design for TVA Steam Plants**
GEORGE P. PALO, A.M. ASCE; Engineer, Tennessee Valley Authority, Knoxville, Tenn.

Discussion

3:30 **Design of Buford Powerhouse**
JACK L. SCHNITZ, A.M. ASCE; Erik Floor & Assocs., Chicago, Ill.

4:00 **Discussion**
J. J. DANAHER, Engineer, Mobile District, Corps of Engineers, Mobile, Ala.

Sanitary Engineering Division

2:00 p.m. **Empire Room**

Presiding: Ralph H. Fuhrman, Member, Executive Committee, Sanitary Engineering Division, and C. E. Drummond, President, Georgia Section

Symposium on Water Resources

2:00 **National Water Policy Problems**
THORNDIKE SAVILLE, M. ASCE; Dean, College of Engineering, New York University, New York, N.Y.

2:30 **General discussion**

2:45 **Sanitary Engineering Problems in Reservoir Management**
FRANK B. WOOD, A.M. ASCE; Sanitary Engineer, South Atlantic Division, U. S. Corps of Engineers, Atlanta, Ga.

3:15 **Twin Problems—Conservation and Engineering**
DR. CLARENCE COTTAM, Asst. Director, U. S. Fish & Wildlife Service, Washington, D.C.

3:45 **Formal discussion**
LOUVA G. LENERT, M. ASCE; Director of Public Health Engineering, State Dept. of Health, Atlanta, Ga.

4:00 **A Pollution Study of the Potomac River**
M. H. KLEGERMAN, A.M. ASCE; Consulting Engineer, Alexander Potter Assocs., New York, N.Y., and T. M. NILES, M. ASCE, Partner, Greeley & Hansen, Chicago, Ill.

4:30 **General discussion**

Structural Division

2:00 p.m. **Ballroom**

Presiding: R. N. Bergendoff, Chairman, Executive Committee, Structural Division

2:00 **Eugene Talmadge Memorial Bridge, High Level Crossing of Savannah River**
ALFRED HEDEFINE, M. ASCE; Parsons, Brinckerhoff, Hall & Macdonald, New York, N.Y.

2:45 **Design of the Alabama Livestock Coliseum**
RICHARD J. ADAMS, Sherlock, Smith & Adams, Montgomery, Ala.

3:30 **Design of the West Bypass, Atlanta Expressway**
JOSEF C. PATCHEN, A.M. ASCE; Patchen and Zimmerman, Atlanta, Ga.

ICEBREAKER PARTY

Wednesday, Feb. 17 **5:30–7:00**
Exhibition Hall

Cocktails and entertainment.
Georgia Tech Glee Club will sing.
Courtesy of the Georgia Section.

THURSDAY MORNING

Feb. 18

The following Divisions will hold technical sessions Thursday morning: City Planning, Sanitary Engineering, Soil Mechanics and Foundations, Structural, Waterways.

City Planning Division

9:30 a.m. **Room 10**

Presiding: Harry W. Alexander, Member, Executive Committee, City Planning Division

9:30 **The Atlanta Expressway System**
MOSES E. COX, M. ASCE; Engineer and Executive Secretary, Joint Bond Commission, Atlanta, Ga.

10:30 **Integration of Local Streets with the Atlanta Expressway System**
KARL A. BEVINS, Traffic Engineer, City of Atlanta, Ga.

Soil Mechanics and Foundations Division

9:30 a.m. **Pompeian Room**

Presiding: W. J. Turnbull, Member, Executive Committee, Soil Mechanics and Foundations Division

9:30 **Soil and Foundation Problems in the Southern Piedmont Region**
GEORGE F. SOWERS, A.M. ASCE, Professor of Civil Engineering, Georgia Institute of Technology, Atlanta, Ga.

10:15 **Soil Mechanics and Geologic Features, Buford Project**
WILLIAM V. CONN, Geologist, Corps of Engineers, South Atlantic Division, Atlanta, Ga.

11:00 **Foundation Conditions in the Charleston, South Carolina, Area**
L. K. HIMELRIGHT, A.M. ASCE; Assistant Professor, Civil Engineering, The Citadel, Charleston, S.C.

Sanitary Engineering Division

9:00 a.m. **Empire Room**

Presiding: Daniel A. Okun and W. N. Grune, Members, Program and Publications Committee, Sanitary Engineering Division

Symposium on New Horizons in Sanitary Engineering

9:00 **Film: Construction of the Facilities for the Orinoco Mining Co. in Venezuela.**

9:30 **Sanitary Facilities for Orinoco Mining Co., Venezuela**
CARL A. ARENANDER, M. ASCE; Malcolm Pirnie Engineers, New York, N.Y.

10:00 **Our Rapidly Changing Technology: Its Impact on Sanitary Engineering**
MARK D. HOLLIS, M. ASCE; Assistant Surgeon General, U. S. Public Health Service, Washington, D.C.

10:30 **Reclamation of Salt Water by Electrolysis**
ROLF ELIASSEN, M. ASCE; Professor of Sanitary Engineering, Massa-

chusetts Institute of Technology, Cambridge, Mass.

11:00 **General discussion**

11:15 **Penetration of Floc Into Sand Filters Measured with Radiotracers**

DONALD R. STANLEY, Associated Engineering Services Ltd., Edmonton, Alberta, Canada.

11:45 **Formal discussion**

HAROLD A. THOMAS, JR., M. ASCE; Assoc. Prof. of Sanitary Engineering, Division of Applied Sciences, Harvard University, Cambridge, Mass.

Structural Division

9:30 a.m. **Ballroom**

Presiding: George Brandow, Member, Executive Committee, Structural Division

9:30 **Prestressed Concrete Design**

H. C. SAXE, J.M. ASCE; Associate Professor, Civil Engineering, Georgia Institute of Technology, Atlanta, Ga.

10:15 **The Buford Project**

CARL E. BENTZEL, Engineer, Mobile District, Corps of Engineers, U.S. Army.

11:00 **Savannah River Bridge**

C. N. CROCKER, M. ASCE; Bridge Engineer, Georgia State Highway Dept., Atlanta, Ga.

Waterways Division

9:30 a.m. **Room 14**

Presiding: Carl B. Jansen, Chairman, Executive Committee, Waterways Division

9:30 **Deep-Water Harbors in the Southeast**

DONALD P. BILLARD, Engineer, South Atlantic Division, Corps of Engineers, U.S. Army, Atlanta, Ga.

10:00 **Sediment Sampling in Tidal Waterways**

EDWARD A. SCHULTZ, A.M. ASCE; Engineer, Charleston District, Corps of Engineers, U.S. Army.

10:30 **Problems Involved in the Improvement of a Fresh Water Stream as a Deep-Water Harbor**

HARRY SUGDEN, A.M. ASCE; Engineer, Savannah District, Corps of Engineers, U.S. Army, Savannah, Ga.

11:00 **Navigation on the Warrior-Tombigbee River System**

RALPH W. MUELLER, Engineer, Mobile District, Corps of Engineers, U. S. Army, Mobile, Ala.

CONVENTION LUNCHEON

Thursday, Feb. 18 **12:15 p.m.**

Exhibition Hall

Presiding: James A. Higgs, Director, District 10, ASCE

Features an address by DEAN DANIEL V. TERRELL, President of ASCE.

All members, their ladies and guests, and friends of ASCE are cordially invited.

Price: $2.00 per plate. Tickets for this event must be purchased before 10:00 a.m., Thursday.

THURSDAY AFTERNOON

FEB. 18

Inspection Trip

An excursion to the Buford Dam Project under construction by the Corps of Engineers via the Atlanta Expressway has been planned. Busses will leave the front entrance of the Biltmore Hotel at 1:45 p.m., returning to the Hotel about 5:30 p.m.

Price $1.00 per person. Tickets for this event must be purchased before 12:00 Noon, Thursday.

The following Divisions will hold technical sessions on Thursday afternoon: Air Transport, Highway, Irrigation and Drainage, Surveying and Mapping.

Air Transport Division

2:00 p.m. **Room 12**

Presiding: J. Moran Roberts, M. ASCE, Robert & Co., Atlanta, Ga.

2:00 **Planning of Air Force Bases**

PAUL C. BROWN, M. ASCE; Colonel, O.I.C., USAF Installations Representative, South Atlantic Division, Atlanta, Ga.

2:20 **Planning of the Modern Air Base**

PAUL J. HOUFEK, Chief, Airfield Planning Division, USAF Installations Representative, South Atlantic Division, Atlanta, Ga.

2:45 **Recent Research on Airfield Paving—Base and Surface Course**

W. J. Turnbull, M. ASCE, Chief, Soils Division, Waterways Experiment Station, Corps of Engineers, Vicksburg, Miss.

3:30 **Airport Planning**

PAUL H. STAFFORD, Staff Engineer, Porter, Urquhart & Beavin, Newark, N.J.

Highway Division

2:00 p.m. **Empire Room**

Presiding: DeWitt C. Greer, M. ASCE, State Highway Engineer, Texas State Highway Department

2:00 **Soil-Cement Helps Solve Road Building Problems in the Southeast**

H. J. MCDARGH, M. ASCE; Southeastern Regional Manager, Portland Cement Association, Atlanta, Ga.

2:45 **Application of Production Studies to Highway Maintenance Programming and Scheduling**

FRED FARRELL, Bureau of Public Roads.

3:30 **How Maryland Is Solving Its Highway Problem**

WILLIAM CHILDS, Chief Engineer, Maryland State Roads Commission.

Irrigation and Drainage Division

2:00 p.m. **Room 10**

Presiding: Andrew P. Rollins, Member, Executive Committee, Irrigation and Drainage Division

2:00 **Introductory Statement by Chairman**

2:10 **Factors Influencing the Development of Irrigation in Humid Areas**

TYLER H. QUAKENBUSH, Head of Engineering Division, Irrigation Section, Soil Conservation Service, Washington, D.C.

2:35 **Soil and Moisture Factors Used in Design of Sprinkler Irrigation Systems in Humid Areas**

FRED H. LARSON, M. ASCE; Acting Chief, Design and Construction Division, Soil Conservation Service, Upper Darby, Pa.

3:00 **Drainage in Humid Areas of United States**

JOHN G. SUTTOM, Head, Drainage Section, Soil Conservation Service, Washington, D.C.

3:30 **Effect of Introduction of Irrigation on Rural and Urban Economy of a Sub-Humid Area**

WILLIS C. BOEGLI, Economist, Bureau of Reclamation, Amarillo, Tex.

4:00 **Irrigation Potentialities in Arkansas**

PAUL H. BERG, A.M. ASCE; Arkansas-White-Red Rivers Investigations, Bureau of Reclamation, Tulsa, Okla.

4:25 **General discussion**

Surveying and Mapping Division

2:00 p.m. **Ballroom**

Presiding: H. B. Aikin, Member, Executive Committee, Surveying and Mapping Division

2:00 Photogrammetry and Its Application
ALFRED O. QUINN, A.M. ASCE; Chief, Engineering and Field Survey, Aero Service Corp., Philadelphia, Pa.

2:30 Aerial Mapping of Buford Reservoir
F. C. RILEY, Engineer, Park Aerial Service, Inc.

3:00 Aerial Surveys for Reservoir Planning
FRANCIS J. GUSCIO, A.M. ASCE; Chief, Master Planning Branch, South Atlantic Division, Corps of Engineers, U.S. Army, Atlanta, Ga.

3:30 Georgia's Proposed Plat Law
C. R. ROBERTS, Engineer and Surveyor, Atlanta, Ga.

DINNER AND DANCE

Thursday, Feb. 18

Exhibition Hall

7:30 p.m. Dinner
9:30 p.m. Dancing and Entertainment

Informal dress. Per plate, $5.00.

Tickets for this event must be purchased before 10:00 a.m., Thursday.

FRIDAY MORNING

FEB. 19

The following Divisions will hold technical sessions on Friday morning: Air Transport, Construction, Hydraulics, Sanitary Engineering, Soil Mechanics and Foundations.

Air Transport Division

9:30 a.m. **Room 2**

Presiding: A. B. Curry, Director, Dade County Port Authority, Miami, Fla.

9:30 Development of an International Airport
EARLE M. RADER, M. ASCE; Consulting Engineer, Miami, Fla.

10:15 Design of Airport Terminal Buildings
RICHARD D. SEABORN, Former Chief, Building Section, Civil Aeronautics Administration, Atlanta, Ga.; H. ORVILLE VARTY, Steward & Skinner, Architects, Miami, Fla.

11:00 Testing for the Construction and Evaluation of Airport Pavements
F. M. BELL, A.M. ASCE; and C. J. CHUNN, Engineers, Corps of Engineers, South Atlantic Division, Testing Laboratory, Atlanta, Ga.

Construction Division

9:30 a.m. **Room 14**

Presiding: Warren N. Riker, Chairman, Program Committee, Construction Division

9:30 Design and Construction Features of New Port Facilities at Savannah, Ga., and Wilmington, N. C.
HARRY C. ROBERT, JR., M. ASCE; Structural Engineer, Robert & Company Associates, Atlanta, Ga.

10:00 Construction of the Buford Project
CHARLES A. JACKSON, Resident Engineer, Buford Dam Project, Corps of Engineers, South Atlantic Division, Atlanta, Ga.

10:30 Clark Hill Dam Powerhouse
W. A. GIDDINGS, Chief Engineer, Stolte, Inc., Oakland, Calif.

11:00 Classification or Grading of Construction Cost Estimates
GEORGE WRIGLEY, JR., M. ASCE; Vice President, J. E. Sirrine Company, Greenville, S.C.

Hydraulics Division

9:30 a.m. **Ballroom**

Presiding: J. B. Tiffany, Member, Executive Committee, Hydraulics Division

9:30 Meandering and Braiding in Rivers
LUNA B. LEOPOLD, A.M. ASCE; Hydraulic Engineer; and M. G. Wolman, Geologist, U.S. Geological Survey, Washington, D.C.

10:00 Discussion
C. P. LINDNER, M. ASCE; Chief Engineer, South Atlantic Division, Corps of Engineers, U.S. Army, Atlanta, Ga.

10:15 Graphical Analysis of Diversion Flows Through Buford Dam Conduits
FRANCIS F. ESCOFFIER, Hydraulic Engineer, Mobile District, Corps of Engineers, U.S. Army.

10:45 Discussion
M. R. CARSTENS, A.M. ASCE; Associate Professor of Civil Engineering, Georgia Institute of Technology, Atlanta, Ga.

11:00 Pump-Turbine Installation at TVA's Hiwassee Project
DONALD H. MATTERN, M. ASCE; Project Planning Branch, Tennessee Valley Authority, Knoxville, Tenn.

11:30 Discussion
RICHARD S. WOODRUFF, A.M. ASCE; Alabama Power Company, Birmingham, Ala.

Sanitary Engineering Division

9:00 a.m. **Empire Room**

Presiding: Roy J. Morton, Member, Executive Committee, Sanitary Engineering Division, and Paul W. Richards, M. ASCE, U.S.P.H.S., Southeast Drainage Basins

Symposium on Stream Pollution

9:00 Tennessee Stream Pollution Control—Past, Present and Future
R. P. FARRELL, Director, Sanitary Engineering, Department of Public Health, Nashville, Tenn.

9:30 How Virginia Is Attacking Stream Pollution
A. H. PAESSLER, Executive Secretary, State Water Control Board, Richmond, Va.

10:00 Cooperation—A Primary Tool of the Engineer in the Solution of Stream Pollution Problems.
JAMES A. JARRETT, A.M. ASCE; Director, Sanitary Engineering, State Board of Health, Raleigh, N.C.

10:30 Interrelation of Stream Regulation and Stream Pollution
CHARLES M. DAVIDSON, Chief, Industrial Hygiene Branch; and MILO A. CHURCHILL, A.M. ASCE; Chief, Stream Sanitation Section, TVA, Chattanooga, Tenn.

11:00 Discussion
LEWIS A. YOUNG, M. ASCE; Officer in Charge, Division of Water Pollution Control, U.S.P.H.S., Southeast Drainage Basins, Atlanta, Ga.

11:15 General discussion

Soil Mechanics and Foundations Division

9:30 a.m. **Room 10**

Presiding: Ralph Fadum, M. ASCE, Head, Civil Engineering Department, North Carolina State College

9:30 Soil Problems at the Proposed Hartwell Dam
W. K. THOMPSON, J.M. ASCE; Engineer, Savannah District, Corps of Engineers, U.S. Army.

10:15 The Georgia State Highway Dept. Classification of Subgrade and Embankment Soils
LARRY FREEMAN, Materials Engineer, Georgia State Highway Dept.

11:00 Fill Utilization for Building Foundations
GORDON B. DALRYMPLE, J.M. ASCE; Law-Barrow-Agee Laboratories, Inc., Atlanta, Ga.

Division Luncheons

The following Division Luncheons are scheduled for Friday noon:

Hydraulics Division: T-Room Brittain Dining Hall, Georgia Tech. Campus, 12:30 p.m.

$2.00 per person

Sanitary Engineering Division: Mammy's Shanty, 1480 Peachtree Street, N.W., 12:30 p.m.

Sanitary Engineering Under Point IV in the Near East

RICHARD KING, A.M. ASCE; Associate Professor of Civil Engineering, Georgia Institute of Technology.

$1.50 per person. Tickets for these events must be purchased before 5:00 p.m., Thursday.

FRIDAY AFTERNOON

FEB. 19

The following Divisions will hold technical sessions on Friday afternoon: Construction, Hydraulics, Sanitary Engineering, Soil Mechanics and Foundations.

Construction Division

2:00 p.m. **Room 14**

Presiding: Ben C. Gerwick, Jr., M. ASCE, Member, Program Committee, Construction Division

2:00 Construction of Atlanta Expressway System

B. P. MCWHORTER, M. ASCE; Division Engineer, Bureau of Public Roads, Atlanta, Ga.

2:30 The Place of the Testing Laboratory in Engineering Construction

GEORGE H. NELSON, Executive Vice President, Law-Barrow-Agee Laboratories, Inc., Atlanta, Ga.

3:00 Discussion on Mr. Nelson's Paper

JOHN H. C. SPRAGUE, A.M. ASCE; Director, Division Laboratory, South Atlantic Division, Corps of Engineers, U.S. Army.

3:30 Bay St. Louis Bridge Project

JOSEPH PERAINO, A.M. ASCE; Chief Structural Design Engineer, New York Marine and Heavy Construction Division, Merritt-Chapman and Scott, New York, N.Y.

4:00 Safety Is an Engineering Problem

WILLIAM A. LUNA, M.ASCE; Civil Engineer, Liberty Mutual Insurance Co., New York, N.Y.

Hydraulics Division

2:30 p.m. **T-Room, Brittain Dining Hall, Georgia Tech Campus**

Presiding: C. E. Kindsvater, M. ASCE, Chairman, Committee on Research, Hydraulics Division

2:30 Discharge Characteristics of Bridge Openings

R. W. CARTER, A.M. ASCE; Hydraulic Engineer, U.S. Geological Survey, Atlanta, Ga.

3:00 Backwater Due to Width Constrictions in Open Channels

H. J. TRACY, Hydraulic Engineer, U.S. Geological Survey, Atlanta, Ga.

3:30 Inspection of Hydraulics Laboratory

School of Civil Engineering, Georgia Institute of Technology, Atlanta, Ga.

Soil Mechanics and Foundations Division

2:00 p.m. **Room 10**

Presiding: George F. Sowers, A. M. ASCE, Professor of Civil Engineering, Georgia Institute of Technology

2:00 Mixed-in-Place Intrusion Grout Elements

NORMAN L. LIVER, JR., J.M. ASCE; ERWIN C. MARDORF, and JOHN C. KING, Intrusion-Prepakt Co., Cleveland, Ohio.

2:45 Capacity of Franki Foundations

ARTHUR J. BULGER, M. ASCE; President, Franki Foundation Co., Pittsburgh, Pa.

3:30 The Drilled Foundation Pier

JACK MCKINNEY, McKinney Drilling Co., Nacagdoches, Tex.

Sanitary Engineering Division

2:00 p.m. **Empire Room**

Presiding: Robert E. Stiemke, M. ASCE, Director, School of Civil Engineering, Georgia Tech; and Richard King, A.M. ASCE, Associate Professor of Civil Engineering, Georgia Tech.

Symposium on Problems of Industrial Wastes Treatment

2:00 Present Methods of Radioactive Waste Disposal

JOSEPH A. LIEBERMAN, Sanitary Engineer, U.S. Atomic Energy Commission, Washington, D.C.

2:30 Characteristics and Waste Disposal Problems in the Chemical Industry

H. L. JACOBS and R. W. HAYWOOD, JR., Engineering Department, E. I. du Pont de Nemours & Co., Wilmington, Del.

3:00 Control, Treatment and Disposal of Kraft Pulp and Paper Mill Effluents

WILLIAM A. MOGGIO, Resident Engineer, National Council for Stream Improvement, Inc., Louisiana State University.

3:30 Problems of Waste Disposal in the Synthetic Textile Industry

LOUIS W. ROZNOY, Technical Consultant, Celanese Corp. of America, Charlotte, N.C.

4:00 Industrial Waste Process Design

W. W. ECKENFELDER, JR., Weston, Eckenfelder & Hood, Ridgewood, N.J.; and D. J. O'CONNOR, J.M. ASCE; Assistant Professor, Manhattan College, New York, N.Y.

4:30 Discussion

LADIES ENTERTAINMENT

Ladies Headquarters: Room 6, Mezzanine Biltmore Hotel

The hospitality room will be open from 9:00 a.m. to 5:00 p.m., Monday through Friday. Hostesses will be there to assist you.

Wednesday, Feb. 17

Morning

9:00 to 11:00 Welcoming Coffee, Room 6

Afternoon

2:00 to 4:00 Sightseeing tour of residential Atlanta

Busses will leave front entrance of Biltmore Hotel promptly at 2:00 p.m. and will take ladies directly to tea.

4:00 Tea

At home of Mrs. Blake R. Van Leer, wife of the President, Georgia Institute of Technology. Busses will return ladies to Hotel.

5:30 to 7:30 Icebreaker Party

Exhibition Hall, Biltmore Hotel.

There will be no charge for Wednesday activities for ladies.

Thursday, Feb. 18

Morning

9:00 Morning call for coffee

In Room 6.

9:30 Sightseeing bus tour

To Stone Mountain, Cyclorama, Emory University and other points of interest. Busses will leave front entrance of Biltmore Hotel promptly at 9:30 a.m. and will take ladies to luncheon after the tour.

Afternoon

1:00 Luncheon, Piedmont Driving Club

Following the luncheon, busses will take the ladies to tea.

4:00 Tea and Style Show at Rich's, Inc.

Convenient public transit service is available to return to hotel.

Price: $4.00 per person includes ladies' activities for all day Thursday, except the dinner dance.

Tickets for this event must be pur-

chased before 5:00 p.m., Wednesday.

7:30 Dinner Dance
Exhibition Hall, Biltmore Hotel.

Friday, Feb. 19

Morning

9:00 Morning call for coffee.
In Room 6.

9:30 Brunch at Franklin Simon's
Courtesy of the Georgia Section. Please register at Ladies Headquarters before 5:00 p.m., Thursday.

A word on the weather: Although February in Atlanta is commonly known as "camellia weather" it will be wise to bring along a suit and a top coat or fur coat.

FACULTY ADVISERS CONFERENCE

Thursday, Feb. 18

Room 2, Mezzanine, Biltmore Hotel

Presiding. George W. Bradshaw, Chairman, Committee on Student Chapters

This will be an all-day conference for Faculty Advisers and Contact Members of Student Chapters. Other Interested Members are invited to attend.

STAFF AND PRESS ROOM

Saturday, Feb. 13 to Friday, Feb. 19

Room 3

For the convenience of the technical press, newspapers and radio, a press room will be open throughout the days of the Convention. Members of the Public Relations Committee will be on hand to provide information.

STUDENT LUNCHEON

Friday, Feb. 19 12:30 p.m.

Pompeian Room

James A. Higgs, Director, District 10, presiding

Address: HUGH M. COMER, Avondale Mills, Birmingham, Ala.

All students, faculty advisers, contact members, members of the Board of Direction and members of ASCE are cordially invited.

Price, $2.00 per plate except students, $1.50 per plate. Tickets for this event must be purchased by 10:00 a.m., Friday

STUDENT CHAPTER PROGRAM

Friday Morning, Feb. 19

Pompeian Room

Presiding: Paul C. Brown, Col. USAF, Contact Member, and Sidney E. Hawkins, President, Georgia Tech Student Chapter, ASCE

9:30 Welcome
BLAKE R. VAN LEER, President, Georgia Institute of Technology.

9:45 Intangibles in Engineering
FRANCIS M. DAWSON, M. ASCE, Dean, College of Engineering, State University of Iowa.

10:30 Papers by students of various colleges in the region

Friday Afternoon Feb. 19

Ballroom

Presiding: Paul C. Brown, Col. USAF, Contact Member, Georgia Tech Student Chapter, ASCE

2:30 World-Wide Opportunities for Engineers
L. W. "Chip" Robert, Jr., M. ASCE, Robert and Company, Associates, Atlanta, Ga.

3:15 Papers by students of various colleges in the region.

4:30 Meeting of Southeastern Conference of Student Chapters.

STUDENT DINNER DANCE

Friday, Feb. 19

Atlanta Biltmore Hotel, Pompeian Room

7:30 p.m. Dinner
9:30 p.m. Dancing and Entertainment

The Dinner Dance is sponsored by the Georgia Institute of Technology Student Chapter, ASCE.

Price: $3.00 per person. Tickets of this event must be purchased by 10:00 a.m., Friday

STUDENT TOUR

Saturday, Feb. 20

Morning

9:30 Student tour of Southern Railway facilities in Atlanta area
Arranged by Southern Railway members of ASCE.
No charge for students.

Afternoon

12:30 Student Luncheon
No charge for students.

HOTEL RESERVATIONS

Since all requests for rooms will be handled chronologically, it is recommended that you send in your reservation as soon as possible. The Atlanta Biltmore Hotel will be the Convention Headquarters, but rooms will be available at three adjacent hotels, the Georgian Terrace, the Cox Carlton, and the Peachtree Manor.

In making hotel reservations, please use the blank on page 103. Indicate your first, second and third choice. Rates are as follows:

Atlanta Biltmore
Single: $5.00–$10.00
Double: $8.00–$13.00
Studio Rooms: Single $7.00–$10.00
Two Persons $9.00–$12.00
Suites: Parlor and Bedroom for one or two persons $15.00–$25.00
Parlor, Dining Room, Two Twin Bedrooms and one Double Bedroom for five or six persons $40.00–$45.00

Georgian Terrace
Twins: $10.00–$11.00

Peachtree Manor
Single: $5.00–$6.00
Twins: $8.50–$10.00
Suites: Double $12.50
For three $15.00

Cox Carlton
Twins: $6.00–$8.00

ATLANTA CONVENTION COMMITTEES

Moses E. Cox, *General Chairman*
James A. Higgs, *Director, District 10*

General Convention Committee
C. E. Drummond James A. Higgs
Raymond J. Gauger, *Augusta Subsection*
Robert E. Stiemke James B. Wilson
Charles F. Trainor, *Savannah Subsection*
Thomas H. Winchester

Entertainment
Warren S. Mann, *Chairman*

Exhibits
W. F. Abercrombie, *Chairman*

Excursions
Paul Weir, *Chairman*

Finance
Benjamin M. Hall, Jr., *Chairman*

Hotel Arrangements
Van Porter Enloe, *Chairman*

Hotel Reservations
Jack W. Carney, *Chairman*

Ladies Activities
Mrs. C. E. Drummond, *Chairman*
Mrs. R. E. Stiemke, *Co-chairman*

Local Sections Cooperation
M. T. Thomson, *Chairman*

Public Relations
Burton J. Bell, *Chairman*

Reception
M. L. Shadburn, *Chairman*

Registration
Harold J. Spaeder, *Chairman*

Student Activities
Paul C. Brown, *Chairman*

Technical Program
Clement P. Lindner, *Chairman*

Transportation
Sam R. Young, *Chairman*

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The chart tells you, among other things, *which* Kodagraph Materials are specifically designed to give you sharp, clean intermediate prints of old, soiled drawings; which Kodagraph Materials are best for reproducing blueprints, microfilm negatives, drawings with extremely fine detail, printed halftone pages, etc.

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SOCIETY NEWS

General Committee for ASCE Atlanta Convention Meets

Plans for a successful Atlanta Convention of the Society are being perfected by the Atlanta Convention General Committee at a meeting with its chairman Moses E. Cox and the two ladies who head the Women's Activities Committee—Mrs. C. E. Drummond, Jr., and Mrs. Robert Stiemke. Seated, left to right, are S. R. Young, C. P. Lindner, R. E. Stiemke, Chairman Cox, ASCE Director James A. Higgs, and B. J. Bell. Standing, in same order, are V. P. Enloe, H. J. Spaeder, Jack Carney, M. T. Thomson, Col. Paul Brown, Mrs. R. E. Stiemke, Mrs. C. E. Drummond, Jr., Robert O. Harris, M. L. Shadburn, C. E. Drummond, Jr., and J. B. Wilson. The Convention program is given in full detail elsewhere in this issue.

Notice

General Business Meeting Of Society Is Called

A general business meeting of the American Society of Civil Engineers is called for 9:00 a.m., Wednesday, February 17, 1954. The place will be the ballroom of the Atlanta Biltmore Hotel, Atlanta, Ga. Principal item of business for this business meeting is consideration of petitions for amendment of the constitution.

ASCE Headquarters has received the necessary 200 or more signatures of members from each of the four Zones to petitions requesting an amendment to the constitution affecting dues. This action on the part of the membership assures that the amendment affecting dues will be placed before the membership for discussion at a general business meeting.

The petition reads: "We, the undersigned members of the American Society of Civil Engineers, resident in the Zone above designated, do hereby petition for an amendment to Article IV, Section 2 of the Constitution of the Society, to provide for payment of annual dues by members of the Society, wherever resident, on the following basis:

Members—$25 Associate Members—$25
Affiliates—$25 Junior Members—$15"

1954 Membership Roster Is Free on Request

The new Society Directory for 1954, containing a roster of membership, is currently available for mailing to members without charge. Copies will be distributed automatically to officers of the Society and to Local Sections. Otherwise, members must request their copies, by means of the coupon provided on page 123, which is to be filled in and mailed to Society Headquarters. The new directory contains both alphabetical and geographical listings. A separate list of the living members who have attained life membership status, and a complete roster of the Society's Honorary Members are also included, as in former years.

When the last directory was published, in January 1952, the Society had slightly more than 33,000 members. Two years later, the membership numbers some 36,800.

ASCE "Transactions" For 1953 Available

The 41 technical papers that make up the currently available 1953 TRANSACTIONS, Volume 118, contribute significantly to the high standards traditional with this publication. Three symposia, the final report of a committee on flood frequency, and memoirs of 51 deceased members fill a portion of the 1,360 pages of this year's volume.

Nearly all the Technical Divisions of ASCE have sponsored papers, insuring a breadth of subject matter. Subjects explored exhaustively in symposium form are "The Delaware Memorial Bridge" (two papers), "Engineering Aspects of Water Waves" (five papers), and "Electrical Analogies and Electronic Computers" (five papers). The large number of memoirs marks progress under an altered policy instituted with the 1952 TRANSACTIONS, and is believed to enhance the value of the book.

The Society first received technical papers for publication in 1868, and the current volume will represent the eighty-second year since Volume I of the TRANSACTIONS of the Society was printed. Discussers from the United States and abroad have submitted contributions that make this year's volume a valuable addition to the set. The complete index in TRANSACTIONS gives it special value as a reference work for efficiently finding information and compiling reading lists.

Copies are available to both members and non-members of the Society. Those who are not yearly subscribers to TRANSACTIONS, and who have not previously ordered Volume 118 by other means, may do so by use of the coupon on page 95.

Important Corrections For ASCE Manual No. 31

The usefulness of the Society's Manuals of Engineering Practice is demonstrated continuously by a steady demand for them throughout the technical world. Manual No. 31, *Design of Cylindrical Concrete Shell Roofs*, is perhaps more in demand than any of the others at the present time. Following its publication in 1952, it has been tested continuously by the Subcommittee on Thin Shell Design, working to correlate notices of inadvertent errors mailed in by users. As a result, a six-page list of errata has been prepared to supplement the original printing. Those who purchased the original Manual 31 may obtain the errata by mailing the coupon found on page 107 to Society headquarters, plainly and appropriately filled in.

Third UPADI Convention Is Scheduled for Brazil

The Pan-American Federation of Engineering Associations (UPADI) will hold its third convention in Sao Paulo, Brazil, August 3 to 13, 1954. Western Hemisphere engineers chose Sao Paulo for the meeting in honor of the 400th anniversary of the founding of the city, and to permit attendance at a Sectional Meeting of the World Power Conference, scheduled for Rio de Janeiro, Brazil, July 25–August 8. Sao Paulo will be the center of many conferences and meetings, including the Fourth Inter-American Conference of Sanitary Engineering, July 25–31.

UPADI was organized in 1951 in Havana, Cuba, after a preliminary meeting in Rio de Janeiro in 1949. The Second Convention, held in New Orleans in 1952, coincided with the ASCE Centennial of Engineering and permitted Latin delegates to participate in the observance.

At the Sao Paulo meeting the organization will continue its work on developing standards of practice and professional ethics. Through its Committee on Technical Studies, it will discuss methods of exchanging information on subjects of common interest. But its most important objective will be the establishment of good relations and understanding among engineers of the Americas.

Host for the Convention will be the Brazilian Federation of Engineering Associations, of which F. Saturnino de Brito, filho is president. At the Convention a new slate of officers will be elected to succeed President Luis Giannettassio of Uruguay who has guided UPADI successfully in this initial period.

Opportunities will be provided for tours to sites of interest. Many engineers plan to make the complete swing around South America. A large delegation from the United States and Canada will attend.

ASCE is represented in UPADI through Engineers Joint Council. Any member may make use of UPADI services. Those interested in learning more about UPADI, the Sao Paulo Convention, or about specific Western Hemisphere countries should write T. A. Marshall, Jr., Secretary of UPADI, Box 40, Midtown Station, New York 18, N.Y.

Memorial Bust of Clifford Holland Is Unveiled

A memorial bust of Clifford M. Holland, chief engineer on construction of the tunnel bearing his name between New York and New Jersey, was unveiled at the New York plaza entrance to the tunnel on November 13. In the ceremonies Mr. Holland, who was serving a term as Director of the Society at the time of his death in 1924, was lauded as "one of the greatest engineering geniuses the world has ever known," by Howard Cullman, chief engineer of the Port of New York Authority. "In the twenty-six years since the completion of this, the first long underwater vehicular tunnel, no one has been able to improve upon Clifford Holland's ideas or his methods," Mr. Cullman said. In particular, he praised the ventilation system, which Mr. Holland designed for the two two-mile tubes. Previously vehicular tunnels had been short enough to be kept clear of carbon monoxide gas by natural draft.

Calling Mr. Holland "an inspiration to all civil engineers," ASCE Vice-President George W. Burpee recalled that his plans, "both for methods of construction and for ventilation were subjected to a great deal of criticism, and that his plans were not adopted without being tested in hours of debate. I clearly remember a meeting of the American Society of Civil Engineers in New York," he said, "when the subject of ventilating the tunnel was under discussion, and those who believed the methods to be inadequate and those who believed it was going to be impossible successfully to ventilate the tunnel, were all vehement in the expression of their views—the memory of the way in which Clifford Holland detailed the experimental work which he had devised and which had been done under his direction, the examination which he himself had made of European tunnels, so impressed me that the memory has never left me and stands out as the picture of the great engineer, able to answer the questions of his critics with good humor and with incontrovertible fact."

Ground for the Holland Tunnel was broken October 12, 1920, and it was opened November 12, 1927. Mr. Holland collapsed from overwork and died on October 27, 1924, two days before the east and west segments of the north tube were holed through. He was 41.

Memorial bust of Clifford Holland is dedicated by Howard Cullman, chairman of the Port of New York Authority. The bust, the work of Wheeler Williams, sculptor (right), was unveiled by two young grandsons of Mr. Holland.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

In addition to staging some political fireworks and dramatizing international intrigue, the Nation's Capital has been quietly but busily engaged in holding conferences designed to develop policies for future legislation. This is a usual pattern for the months immediately preceding the opening of a session of Congress.

Water policy, a subject on which both the Society and Engineers Joint Council are regarded as authorities and to which both have made notable contributions, was considered by several important groups.

Water Policy Studied by Hoover Committee

The Task Force on Water Policy of the new Hoover Commission on Organization of the Executive Branch of the Government held its first meeting late in November. Admiral Ben Morcell, Hon. M. ASCE, is chairman of the Task Force, and Charles Curran, a member of the District of Columbia Section, has been selected to direct the staff work.

Four task groups have been set up to prepare preliminary reports. Past-President W. W. Horner will handle flood control; Carey Brown, M. ASCE, navigation; A. B. Roberts, power; and former Governor Miller of Wyoming, reclamation and water supply. These task forces will review a number of current projects with respect to such matters as legal status, necessity, organization, efficiency of handling and possible economies.

A meeting of the whole Commission was held in November, and another is scheduled for January 16. The report of the Hoover Commission is scheduled for the end of 1954. Congress will probably not make major determinations of policy in the water field until then.

Other organizations are also engaged in studying water policy. The Natural Resources Committee of the U. S. Chamber of Commerce, on which Past-President Horner is serving, is developing changes and additions to the Chamber's policy statement on the subject. The EJC Water Policy Panel Report, prepared without great fanfare, is now considered one of the most authoritative documents on sound water policy.

Resources for the Future Conference

Water resources loomed large in the discussions of the Mid-Century Conference on Resources, held in Washington, December 2–4 (page 82). Abel Wolman, M. ASCE, served as co-chairman of the Section considering water problems. Past-President Horner and Director Samuel B. Morris played an important part as members of the steering committee. Thorndike Saville, M. ASCE, served as chairman of one subsection. Various aspects of water resources development problems were considered in three principal subsections: Supply, Use and Competitive Demand; Division of Responsibility Among Private Groups and Various Branches of Government; Evaluation and Reimbursement. Many members of the EJC Water Policy Panel, as well as government engineer members of ASCE, took part in the discussions on water resources.

The conference may prove to be the forerunner of important actions in the field of natural resources development. It overcame many obstacles in bringing initial considerations to a successful conclusion. At an earlier stage, some of the more conservative groups deemed it wise to ask for a postponement from a spring meeting to the December date. At that time the U.S. Chamber of Commerce withdrew as a sponsor, although one of its past-presidents remained as an active organizer. Subsequent to that time prestige was gained by former Ambassador Lewis Douglas' acceptance of the chairmanship. Business groups began to play a more active part. Engineers Joint Council also began active participation.

The purpose of the conference was to formulate the issues involved in resources development. It was not planned to make recommendations for action, although in many cases conclusions were reached as the consensus of those in attendance. There seemed to be particular recognition that the problem involved dynamic management and that the expression "resources management" expressed this idea better than the term "conservation of resources" which had in the past sometimes represented a static notion of locking up our resources for future generations. In addressing the conference, President Eisenhower as well as other prominent speakers, emphasized the idea that wise conservation comprised far-sighted active use, development and positive improvement of our resources.

While the conference agreed that both a master plan imposed from the top and the other extreme of complete anarchy were intolerable, the hope was expressed that conflicting interests would modify extreme positions and work together for mutual benefit. It was agreed that a "spark of leadership" was an essential element in all patterns of cooperation. No unanimity of opinion prevailed with respect to the often proposed Board of Review for water resources projects but it was agreed that this was an important organization issue to be decided.

Research loomed large in the discussions as one of the great hopes for the future. It was generally agreed that our resources problems could not be solved within our boundaries entirely but that international investment and development, as well as foreign trade policies, would play an important part.

Resources for the Future, Inc., is expected to continue working in this field. It is generally understood that the organization will make grants to other groups for carrying out specific assignments in research and study pertaining to resources development. The financing will presumably be made possible in large part from further expected grants from the Ford Foundation to Resources for the Future, Inc.

ASCE-AIA Cooperative Committee

The National Joint Cooperative Committee of ASCE and the American Institute of Architects is the principal influence in keeping the efforts of these two great national organizations in the field of construction and public works coordinated in solving problems of mutual interest. A meeting of the group was held in New York during the ASCE Annual Convention. The ASCE delegation consisted of Co-Chairman Craig Hazelet, Vice-President Mason Lockwood, Vice-President G. Brooks Earnest, with the Field Representative serving as co-secretary.

After a discussion of some conflicts between architects and engineers in one state, there was a review of recent experience in connection with Defense Department contract procedures. It was agreed that, while the difficulties of the past two years have been mitigated, there is need for continued vigilance on the part of the appropriate committees of the two organizations. Of particular concern was the effect of the confused contracting procedures on possible contract renegotiation. Although no such problem had yet arisen in connection with renegotiation, it was agreed that the appropriate staff and committee members should watch developments.

With respect to the renewal of the Renegotiation Act which expires on December 31, it was agreed to recommend to the appropriate committees of both societies that no action be taken regarding renewal of the Act; but that if legislation for its renewal is introduced, support be given the amendment proposing raising the minimum for renegotiating from $250,000 to $500,000.

A subcommittee was authorized to consider problems of Government reorganization which are of joint concern to architects and engineers, and to look at problems relating to the effect of public works programs on the national economy.

The Joint Committee reviewed examples of competitive bidding for professional architectural and engineering services and the

ASCE MEMBERSHIP AS OF DECEMBER 9, 1953

Members	8,472
Associate Members	10,797
Junior Members	17,427
Affiliates	69
Honorary Members	43
Total	36,808
(December 9, 1952	35,682)

action taken in several specific instances with a view to coordinated handling of such cases.

Highway Developments

Highway development is receiving high-level attention in conference discussions. The Western Governors Conference urged the Federal Government to withdraw from the field of gasoline taxation. The status of the Bureau of Public Roads is involved in this proposal. The Chamber of Commerce of the United States sponsored a National Conference on Highway Financing held in Washington, December 10–11. The controversial issue of the assumption of far greater powers and responsibilities by state highway departments with a corresponding withdrawal by the Federal Government was ably discussed from many divergent viewpoints. The Chamber recently issued a pamphlet on Highway Construction—Federal-State Relations—giving a background of information on the federal-aid plan.

Washington, D.C.
December 15, 1953

Freeman Fellowship For 1954 Is Announced

Members of ASCE or the ASME, who wish to follow through a worthy research program in hydraulics or related fields, are given advance notice that a new Freeman Fellowship will be available this coming spring. The normal period of study is nine months. Rules for the award, which is conducted in conjunction with the ASME, are given here:

1. Applicants must submit a program of study or research in hydraulics or related fields, covering a period of at least nine months starting in 1954. A statement of funds needed from the fellowship should accompany applications.
2. Applicants must furnish evidence of qualification to carry out the proposed program.
3. Applicants must be citizens of the United States and members in some grade of either of the two cooperating societies.
4. The Freeman Award Committee will give preference to projects bearing importantly on the defense effort.
5. Applications should be submitted to the Freeman Fund Committee, ASME, 29 West 39th Street, New York 18, N.Y., by February 1, 1954. Announcement of the award will be made on March 15, and the recipient must make a report in English within 60 days of completion of his project.

The maximum amount of grant from the Freeman Fund to a winning applicant has been $2,500.

Society Members Urged to Visit Hawaii

Visitors from the mainland planning to attend the Hawaii Section's all-day meeting in Honolulu on March 1 (page 80 for time and place) are urged not to underestimate the mountains when requesting a hotel reservation. "There's a natural tendency to specify 'ocean view,'" says the Hawaii Visitors Bureau, "but the forested green peaks can be just as inspiring a sight . . . and it's the windows toward the mountains that get the refreshing tradewinds." Shown here is Hanalei Valley, one of the lovely panoramas offered by Kauai, the "Garden Isle."

NOTES FROM THE LOCAL SECTIONS

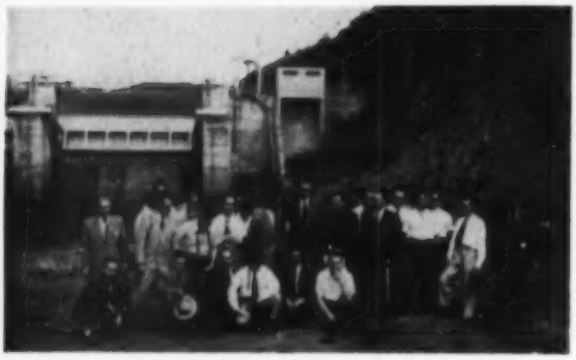
(Copy for these columns must be received by the tenth of the month preceding date of publication.)

New **Alaska Section** officers are Elmer L. Munger, president; John C. Hooper, first vice-president; Amos J. Alter, second vice-president; Wesley H. Butler, secretary; and Kenneth A. Sheppard, treasurer. Officers for the **Juneau Subsection,** elected at a meeting on October 27, are Harold B. Schultz, president; Christian F. Wyller, vice-president; and Gerald J. Miller, secretary-treasurer. S. H. Lorain, Alaska regional director of the U.S. Bureau of Mines, was featured speaker, with a talk on the Bureau's exploratory and development work in Alaska.

The Seven Engineering Wonders in the Buffalo area, as seen by the **Buffalo Section,** are (1) the Rainbow Bridge at Niagara Falls; (2) the Huntley Steam Station at Tonawanda, N.Y.; (3) the Bethlehem Steel Plant at Lackawanna, N.Y.; (4) the Niagara Falls Power Development; (5) the Buffalo Grain Development; (6) the New York Central Terminal Development at Buffalo; and (7) the Ellicott Square Building in Buffalo.

From the methods used by the Egyptians in building the pyramids to present-day techniques on great earthmoving projects was the scope of the talk on "The History of Earthmoving Methods and Equipment," given at the November meeting of the **Central Illinois Section.** The speaker was Raymond C. Gessel, senior field engineer for the LeTourneau-Westinghouse Corp.

To implement its plans for a "Sanitary Engineering Workshop," the **Cincinnati Section** has appointed a committee on arrangements, headed by Arthur D. Caster. Featured speaker at the Section's November 4



Brazil Section Members Visit New Hydroelectric Project

Some 40 members of the Brazil Section enjoy all-day field trip to the Paraiba-Pirai Diversion Project, which is being built in southeastern Brazil by the Brazilian Traction, Light and Power Co. and its interests. At the time of the trip, diversion of the water was complete, except for a few pumps to be installed later, and the first generating unit was about ready to go on the line. Shown in the background is Santana Dam, the smallest of the five projects visited. Eventually the project will have an installed capacity of 720,000 kw, making it one of the largest hydroelectric developments in the world. Articles describing the project were printed in the October and November 1951 issues.

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meeting was Ralph S. Siegrist, sales engineer for the Commercial Shearing and Stamping Co., who showed two films prepared by his company, illustrating the driving of tunnels in rock.

James Lister, city planning director of Cleveland, praised the city's early planners, especially Moses Cleveland, for their foresight in laying out wide streets (some of them 132 ft wide) in the principal talk at the **Cleveland Section's** November 20 dinner meeting. Present-day planning commissions are working to make the community a better place to live in, work in, and invest in, Mr. Lister told the group. New bond issues, voted this fall, cover subways, freeways, road improvements, and welfare projects. ASCE Vice-President G. Brooks Earnest brought the Section up to date on recent Board of Direction activities.

The **Columbia Section** devoted its November meeting, held at Walla Walla, Wash., to discussion of the Seven Wonders in the Inland Empire area. The wonders are (1) the Hanford Atomic Energy Project; (2) Grand Coulee Dam; (3) the Columbia River Basin Irrigation Project; (4) McNary Dam; (5) the Columbia River Basin Comprehensive Plan of Development; (6) the Columbia River and Snake River Navigation Project; and (7) the Bonneville Power Administration Transmission System. The number-one wonder was discussed by J. H. Snyder, of the Hanford Project, who said that Hanford is the only plant in the United States capable of creating a man-made element (plutonium) on an industrial scale. A. J. Davidson, of the Bureau of Reclamation, discussed Grand Coulee Dam, "the largest concrete structure in the world with the largest pumping plant," and the Columbia River Irrigation Project, the third choice. Outstanding features of the next three projects were described by Corps of Engineers personnel—E. C. Franzen, L. E. Rydell, and J. F. Bruce—and the final wonder, the Bonneville Transmission System, was explained by R. P. Walters, of the Bonneville Power Administration.

Former Governor Robert A. Hurley, of Connecticut, took the profession to task in the featured talk at the **Connecticut Section's** dinner meeting on December 2. Speaking on the status and role of the engineer with respect to his place in the community, Mr. Hurley made it clear that "it is pretty much the engineer's own fault his status is what it is, and that it will continue to be unsatisfactory as long as the profession fails to participate actively in community affairs."

The details of forming a Subsection in the Iron Range territory were settled by the **Duluth Section** at a meeting in Hibbing on October 29. The new **Iron Range Subsection,** which has an immediate membership potential of 40, will rotate its meetings among the cities in the area. Temporary Subsection officers are Rodolfo Michels, Jr., of Aurora, Minn., president; Melvin C. Tero, of Hibbing, vice-president; and Henry B. Schmidt, of Virginia, secretary-treasurer.

About 30 members of the **Central Savannah River Valley Subsection** of the **Georgia Section** made a tour of the Refractories Division of the Babcock & Wilcox Company's plant at Augusta as a feature of the November 10 meeting. Questions on operation of the plant were answered at the dinner that followed by Royce K. Mack, superintendent of the Augusta works.

Eleven veteran ASCE members living in the Chicago area received certificates of life membership at the **Illinois Section's** annual luncheon on December 4. Honored were Peter T. Barrett, Charles E. DeLeuw, Abraham Epstein, Harold D. Jolley, Nelson J. Lomax, Thomas C. Mullins, Harvey T. Munn, William H. Trinkaus, William R. Walker, A. M. Westenhoff, and Francis D. Wilson. The Section's new officers, elected at the meeting, are E. M. Fucik, president; Thomas M. Niles, vice-president; and Robert L. Kennedy, secretary.

Utah road problems were outlined at the **Intermountain Section's** November meeting, by D. H. Whittenburg, chairman of the Utah State Road Commission. Mr. Whittenburg said that at present the Commission is opposed to the construction of toll roads and bridges because of the nature of highway travel within the state.

The annual joint meeting of the **Indiana** and **Kentucky Sections,** held at Clifty Falls State Park on November 7 and 8, featured an inspection trip to the Clifty Creek steam-generating plant, which will supply some of the electricity for the new atomic energy plant at Portsmouth, Ohio. Speakers on Society activities were Clyde Williams, president of the Indiana Section; E. C. Thoma, chairman of the District 9 Council; and Warren W. Parks, ASCE Director for District 9. L. E. Gregg, president of the Kentucky Section, was in the chair.

Iowa Section officers for 1954, elected at an afternoon business meeting in Des Moines on November 19, are Neil Welden, president; Glenn Doty, vice-president; and L. O. Stewart, secretary-treasurer. E. T. Jensen, engineer for Donovan, Lovering and Boyle, discussed the construction of the Fort Randall Dam and Powerhouse, and at the evening dinner meeting that followed L. H. Csanyi, professor of civil engineering at Iowa State College, showed films he made on a recent trip to Europe. R. E. Robertson, new life member, received his certificate at the dinner.

A panel of Junior Members presented the program for the October 13 meeting of the **Kansas City Section.** Talks covered the need for increasing Junior interest in Section programs; the need for tightening up registration laws; the need for engineers to take their rightful place in public affairs; and the need for better allocation of engineering manpower. Speakers included Robert F. Banker, Joseph W. Guenther, Hewitt R. Herdlinger, Joseph H. Hummel, and Ralph E. Robison. Carter Callahan was master of ceremonies. The air defense of the United States was the topic of dis-

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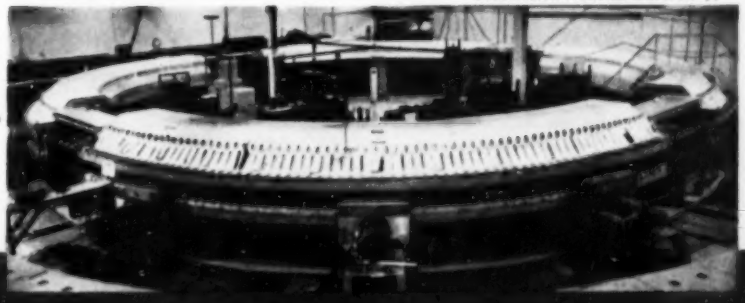

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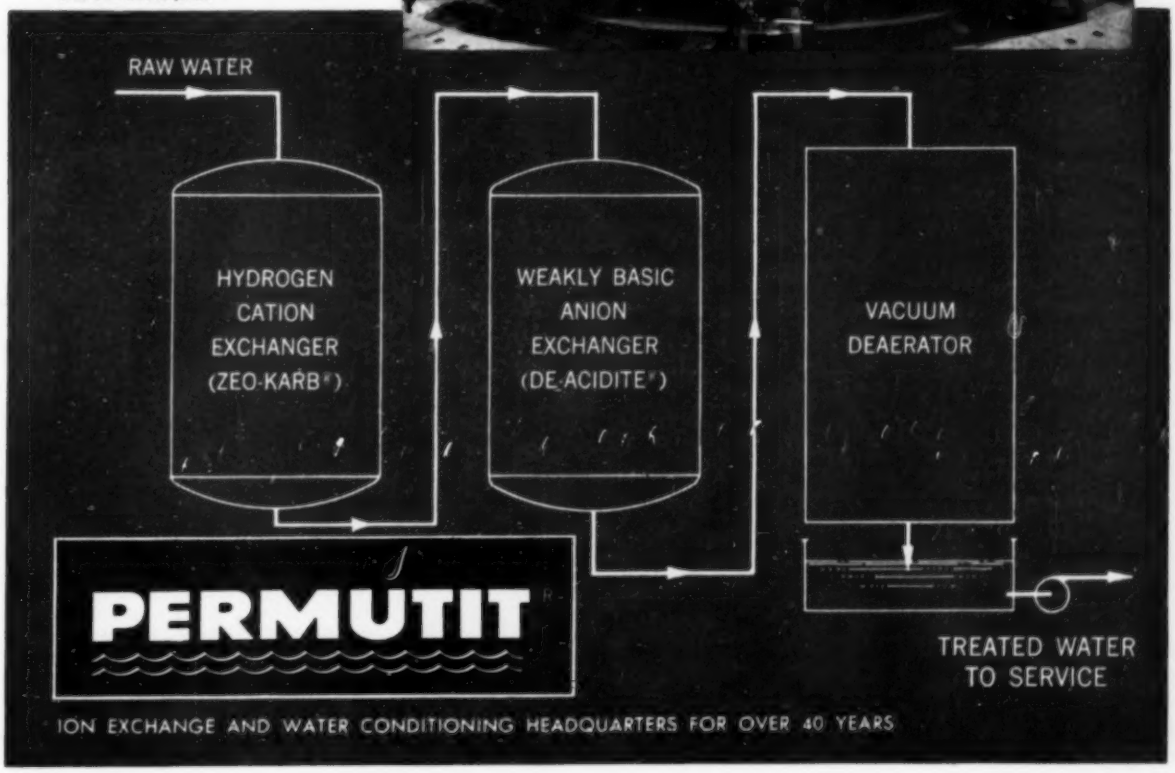
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cussion at the November meeting, and Colonel Lee the principal speaker.

A Hydraulics Group has been formed in the **Los Angeles Section,** with Max Bookman, of the California Division of Water Resources, chairman. The first meeting of the group—in the State Highway Building on January 5—will be devoted to the moot subject of sea water intrusion. Successful Soil Mechanics and Sanitary Engineering Groups are already functioning in the Section.

New officers of the **New Hampshire Branch** of the **Maine Section,** elected at the Branch's first annual meeting in Concord on November 18, are LeRoy F. Johnson, of Concord, president; Russell R. Skelton, of Durham, vice-president; and Warren F. Daniell, Jr., of Concord, secretary-treasurer. Retiring President John O. Morton reported on the Local Section Conference in New York, and a Bethlehem Steel Company film on the Golden Gate Bridge was shown.

Engineers attending the November meeting of the **Miami Section** were advised to build their reports as they would engineering structures in the principal talk given by Dr. William L. Deam, of the University of Miami Speech Department. The construction, he stated, "should embrace the choice of subject, a survey of the field of the subject, selection of data needed, arrangement, and finally the conclusion." Dr. Deam also stressed the importance of delivery. New Section officers, elected at the December meeting, are Robert W. Hart, president; John W. Greenleaf, vice-president; and August De Winkler, Jr., secretary. Herbert J. Morrison was reelected treasurer.

The mission and current activities of the Corps of Engineers in the Little Rock District were outlined at the November meeting of the **Little Rock Branch** of the **Mid-South Section** by Col. Joe A. Clema, district engineer. Results of the election of officers held by the **Memphis Branch** at its November meeting, are James M. Wood, president; Roman Berzowski, vice-president; and Fred Walpole, secretary.

Though more than 90 percent of engineers are employees, few have become members of collective bargaining groups, ASCE Executive Secretary William N. Carey pointed out in the featured talk at the November meeting of the **Nebraska Section.** Speaking on "Engineers and Unionization" Secretary Carey emphasized the role of Engineers Joint Council whose function is "to provide the group effort needed to further the professional and economic advancement of the individual engineer." The turnout of 135 included members of the Nebraska Engineering Society and its affiliates. On the same trip Secretary Carey was also guest speaker at a **Northwestern Section** meeting held in St. Paul on November 16. He discussed ASCE aims and objectives.

The **New Mexico Section's** fall meeting, on October 24, began with inspection of the Jemez Canyon Dam, the state's first flood control structure in the Rio Grande Valley, under the guidance of Col. Lynn C. Barnes, district engineer for the Albuquerque District of the Corps of Engineers. Prominent engineers addressing the technical session included Walter Hall, Edwin Elliott, and Herman Carter of the Middle Rio Grande Project Office of the Bureau of Reclamation, who discussed various phases of reclamation work in the Middle Rio Grande Valley, and Robert O. Davis, regional topographic engineer for the U.S. Geological Survey at Denver, who explained the origin and function of the State Mapping Advisory Committee.

In a talk on the construction of steel penstocks, delivered at the October 28 meeting of the **Oregon Section,** John Silliman, production manager for the American Pipe and Construction Company, cited instances where the designer could reduce the cost of penstocks by considering the structural problems involved. ASCE Director Glenn Holcomb gave a brief report on his trip to the ASCE Annual Convention.

Guest speaker at the **San Diego Section's** October meeting was Admiral William H. Standley, former ambassador to Russia, who gave an interesting picture of Soviet affairs.

Industrial uses for diamonds were described at the November meeting of the **Central Pennsylvania Subsection** of the **Philadelphia Section** by Adrian E. Ross, president of Sprague & Henwood, Inc. Speaking on the subject, "Diamonds are

Tennessee Valley Section Holds Annual Meeting at Knoxville

An exceptionally large turnout—122 members and 68 guests—made this year's annual meeting of the Tennessee Valley Section at the Whittle Springs Hotel, Knoxville, November 13 and 14, a lively and interesting affair for all attending. Clifford Betts, president of the Knoxville Subsection, host to the gathering, presided over the business session which featured talks by Mayor George Dempster and ASCE President Daniel V. Terrell. ASCE Vice-President Edmund Friedman and District 10 Director James A. Higgs later joined in a discussion of President Terrell's address on current Society activities, with emphasis on the need to raise dues. A report on the present status of planning for the Society Convention to be held in Knoxville in June 1956 was presented by Don Mattern, general chairman for the convention. Announcement was also made of the election of Section officers: John C. Voorhees, Knoxville, president; and Albert B. Goodwin, Asheville, vice-president.

ASCE President D. V. Terrell (left) chats with John C. Voorhees of Knoxville, newly-elected president of the Tennessee Valley Section, at annual dinner.

The technical session (attended by approximately 160) was addressed by G. O. Wessenauer, TVA Manager of Power, who spoke on the growth of power use in the Tennessee Valley region, and Dr. John A. Swartout, Deputy Research Director at the Oak Ridge National Laboratory, who discussed the uses of nuclear reaction as a heat source for power. Dr. Swartout said that it will be ten years before we have proof as to whether nuclear reaction plants can produce power competitive with conventional plants.

Members and guests heard Kenneth R. Kaiser, manager of the Rohm and Haas Co. Knoxville plant, describe the history of Plexiglas from its discovery by Dr. Rohm in 1901 in Germany to its present uses in war and peace, at a luncheon in the Whittle Springs dining room.

Life memberships were awarded to James S. Bowman, Harry A. Wiersema, Chatham C. Reams, Clifford A. Betts and Nathan W. Dougherty at the annual dinner. Dean Terrell spoke at the dinner, complimenting the Section for its activity and interest in the Society and hailing the work of the Local Sections, Students Chapter and Junior membership, which he called "the grass roots" of the Society. A square dance, led by Ted Kleinsasser, followed the dinner.

The ladies, who were much in evidence at all sessions, enjoyed a special program that included a trip through the Bearden greenhouses of Baum's Inc., a card game, luncheon and afternoon tea at the home of Mrs. Clarence E. Blee. Many of them also participated in the Saturday inspection trip to the TVA Kingston Steam plant.

Wylie Bowmaster of Knoxville acted as general chairman for the meeting.

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Men's Best Friends Too," Mr. Ross pointed out that the use of diamonds for cutting was known as far back as Biblical times and that today they figure in every major branch of industry, primarily for cutting and accurate shaping. Evidence of this is the fact that ten million carats of diamonds were used in the United States alone in 1952.

Edgar Snow, vice-president of the **Providence Section,** was principal speaker at the Section's November meeting, with a talk on the construction of subaqueous vehicular tunnels by the shield and compressed air method. Slides and movies taken by Mr. Snow during the construction of the Queens-Midtown Vehicular Tunnel were used to explain the various phases of tunnel construction.

A talk on the geology of the Caribbean area by Dr. R. Smith, geologist for the U.S. Geological Survey, constituted the program for the **Puerto Rico Section's** November meeting. A lively discussion on volcanoes and earthquakes followed.

New officers for the **San Francisco Section's Junior Forum,** elected at a meeting in Oakland on November 19, are James E. McCarty, president; Daniel Shapiro, first vice-president; William B. Wilcox, second vice-president; H. Robert Hammill, secretary; and James D. Coolidge, treasurer.

As a public service, the **Seattle Section** has been advising the city administration concerning the qualifications of candidates for professional office, and has stated its willingness to compile a list of qualified personnel that might be of assistance in filling professional posts. Officers for 1954, elected at the November 11 meeting, are Harlan H. Edwards, president; Emil C. Jensen, vice-president; Richard H. Meese, secretary; and Rolf B. Beck, treasurer.

In a talk acclaimed one of the finest of the year, Herbert Humphres, senior materials engineer for the Washington State Highway Department, discussed "Soils as a Foundation" at the **Tacoma Section's** November meeting. Other program features were the showing of an Aluminum Company of Canada film on the Kitimat Project and the election of new officers—Horace J. Whitacre, president; Charles C. McDonald, vice-president; and Harold A. Hagested, secretary-treasurer.

Secretaries were briefed on the finer points of being helpful to the boss at the **Sacramento Section's** second annual "Secretaries' Day," celebrated at the November 10 luncheon meeting. The speaker was Marion Lamb, who described the secretarial training program available at Sacramento State College, and gave good advice to the 163 secretaries escorted to the luncheon meeting by their engineer bosses. The obligations and duties of the civil engineer were stressed by Dr. Erman A. Pearson, professor of civil engineering at the University of California, in the featured address at the November meeting of the Section's **Central Valley Subsection.** In Dr. Pearson's opinion, the increasing demands on the civil engineer will eventually result in the necessity for a five-year engineering curriculum for the engineering student.

ASCE President Daniel V. Terrell was guest of honor and speaker at a luncheon meeting of the **San Antonio Branch** of the **Texas Section** held on October 29, and at a dinner meeting of the **Fort Worth Branch** on November 2. Speaking on Society activities at national level, Dean Terrell said that to prevent curtailment of operations, "correction of the amount of dues paid by Society members is an immediate need." At the Fort Worth meeting, C. M. Davis received a certificate honoring him for his services as president of the Texas Section in 1934.

Toll roads more than 100 or 150 miles long are not feasible in Virginia, Wilbur S. Smith, associate director of the Bureau of Highway Traffic at Yale University, told members of the **Virginia Section** at the banquet concluding the Section's all-day annual meeting on December 4. Mr. Smith, whose firm recently made a survey of the feasibility of a toll road in the Richmond area, said that traffic is not concentrated enough in Virginia to make such routes practicable. Other features included the presentation of certificates of life membership to Archibald H. Bell, of Richmond; Guy Bonney, of Kinsale; and Harold E. Tobey, of Norfolk. Honored in absentia was Edgar M. Hastings, who received a plaque and citation for his services as President of ASCE in 1947. D. C. Hastings, member of the Section and one of the speakers on the technical program, received the plaque for his father, who was ill and unable to attend. During the business meeting Tilton E. Shelburne, of Charlottesville, was elected new Section president; C. S. Mullen, James A. Rives, and Stanley R. Navas, vice-presidents; Frank G. Louthan, Jr., secretary; and Stuart Loughborough, assistant secretary.

Scheduled ASCE Conventions

ATLANTA CONVENTION
Atlanta, Ga.
Hotel Biltmore
February 15–19, 1954

ATLANTIC CITY CONVENTION
Atlantic City, N.J.
Chalfonte-Haddon Hall
June 14–19, 1954

NEW YORK CONVENTION
Hotel Statler
October 18–22
1954

Coming Events

Central Illinois—Annual ladies' night at Urbana, Ill., on January 19.

Delaware—Social hour and dinner meeting at Hanna's Restaurant, Wilmington, January 19, starting at 6 p.m.

Hawaii—All-day meeting program consisting of breakfast, technical sessions, luncheon and dinner dance, at the Queen's Surf, Honolulu, on March 1. For reservations write to Mr. Donald S. Austin, Convention Chairman, Austin and Towill, Civil Engineers, 205 Merchant St., Honolulu, Hawaii.

Kansas—Meeting in Topeka on January 15.

Los Angeles—Dinner meeting on January 13 at 7 p.m. (reservations to be made by calling Secretary Martin Duke at Bradshaw 2-6161, by January 11) followed by a talk at the Roger Young Auditorium. The Junior Forum will hold a meeting at the Roger Young Auditorium on January 13, at 6 p.m., and noon luncheon meetings every Friday at downtown restaurants with the last luncheon of each month at the Engineers Club. The Soil Mechanics Group meets on January 20.

Maine—Augusta area meeting on January 25. New Hampshire Branch meeting will be an open house at the University of New Hampshire, on January 7, with the Student Chapter acting as host.

Metropolitan—Meeting in the auditorium of the Engineering Societies Building, 33 West 39th St., New York, N.Y., on January 20, 7 p.m. Meetings of the Junior Branch in the ASCE Board Room on January 13 and 27, 7:30 p.m.

Northeastern—Annual meeting and election of officers at the Massachusetts Institute of Technology Faculty Club, Cambridge, Mass., on January 25, 5:30 p.m.

Philadelphia—Joint dinner meeting of the Central Pennsylvania Subsection with the Engineers Society of Professional Engineers at the Civic Club, Harrisburg, Pa., January 13, 6:30 p.m.

South Carolina—Annual meeting at the Columbia Hotel, Columbia, S.C., January 22.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

Tacoma—Dinner dance at the Steak House on January 15.

The Newark Housing Authority Project will provide 630 apartments in nine 8-story and three 3-story buildings. Architects: Kruger and Fava, Newark, N. J. Structural engineer: J. Di Stasio and Co., New York City. Contractor: Terminal Construction Corp., Wood Ridge, N. J.

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NEWS BRIEFS . . .

Resources of the United States Studied at Conservation Conference

Nearly 1,500 persons met in Washington, December 2 to 4, at the Mid-Century Conference on Resources for the Future for an examination of the national resources position of the United States. They comprised representatives of industry, labor, science and technology, and government observers.

Most of the work of the conference was done in eight sections, meeting concurrently on various aspects of the resources problem. The basic topics were the following: Section I, Competing Demands for Use of Land; Section II, Utilization and Development of Land Resources; Section III, Water Resources Problems; Section IV, Domestic Problems of Non-Fuel Minerals; Section V, Energy Resources Problems; Section VI, U. S. Concern with World Resources; Section VII, Problems in Resource Research; Section VIII, Patterns of Cooperation. The Land Resources Section had the largest attendance, with the Water Resources Section a close second.

The opening session was a general meeting of the entire conference, for a panel discussion of a paper, "A Mid-Century Look at Resources," prepared by the Brookings Institution as a basic approach to the general and specific problems. President Eisenhower greeted the participants at a luncheon on Wednesday, December 2, expressing his profound interest in conservation, which he defined as "use without waste." There were panel discussions, at two general dinner meetings, December 2 and 3, on control of public lands and world resources. The final session, also, was a general meeting, at which summary reports were presented on the work of the eight sections. After editing and further review, the papers will appear in a complete published report of the Conference to be issued early in 1954.

The Conference was sponsored by the Ford Foundation, former Ambassador Lewis W. Douglas serving as general chairman. The host organization—Resources for the Future, Inc.—is a private corporation fostering research and education in natural resources. Its board chairman is Horace M. Albright of New York, president of the U. S. Potash Co., and former director of the National Park Service. President and executive director is Dr. R. G. Gustavson, formerly chancellor of the University of Nebraska.

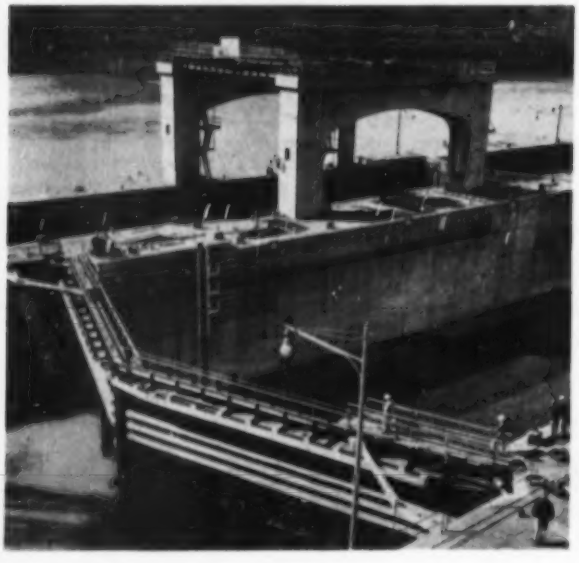
The Ford Foundation has expended nearly $200,000 to date, and it is expected that additional amounts will be forthcoming for the continuing work of Resources for the Future, Inc.

Standards Bureau Upheld In Battery Additive Tests

The National Bureau of Standards has been upheld in its battery testing work by the Jeffries Committee of the National Committee of Sciences. In releasing the Jeffries report, Secretary of Commerce Sinclair Weeks said the committee's rating of the NBS work as "excellent" and "better now than at any time in the past" is "an assurance to the public." The committee concludes "That while Pioneers, Inc., [manufacturers of the additive] claim that AD-X2 [the additive] has substantial merit, the relevant data now available to the committee on the effects of AD-X2 are adequate to support the position of the Bureau of Standards that the material is without merit."

ASCE was represented by Dr. Abel Wolman, of Johns Hopkins University, on a nine-man committee of engineers and scientists, appointed last spring at the request of Secretary Weeks to make an objective study of the Bureau. The study was requested as a result of a controversy that arose over efforts to force the resignation of Dr. A. V. Astin, director of the Bureau, because of dissatisfaction with the testing of the battery additive. As a result of the findings of the investigating committees, Dr. Astin is being retained as director of the Bureau.

New Twin Locks at Pittsburgh to Expedite Monongahela River Traffic



Recent opening of the enlarged and rebuilt Locks No. 2 on the Monogahela River at Braddock, Pa., eliminates a barge traffic bottleneck in Pittsburgh's vital waterways transportation system. The landward lock can now accommodate fourteen 1,000-ton coal barges and a towboat, more than three times its former capacity. The locks were rebuilt for the Army Corps of Engineers by the Contracting Division of the Dravo Corporation. The work posed several problems. In addition to the lack of space for materials storage and construction operations, traffic had to be maintained continuously. Also, water intakes and sewers for the giant Thompson works of the United States Steel Corporation were within the construction area and could not be blocked without endangering production. The proximity of mainline railroad tracks and instability of the earth along the river bank were other complicating factors. In constructing both locks, the contractor had to use a floating plant because the only access from land to the site is a narrow road through the steel mill. All materials were delivered by barge, and a floating concrete mixing plant was used to produce the 250,000 cu yd of concrete needed to build the locks. Emergency dams, installed at the upstream ends of both locks, are used when underwater repairs are necessary. The emergency dam for the riverward lock also can be manipulated to permit passage of flood waters during extremely high river stages. About four and a half years were required for the project, which cost $17,200,000.

Engineers' Starting Salaries Up 11 Percent This Year

Results of a recent survey conducted by the Cooper Union indicate that nearly one out of five of its June 1953 graduates from the School of Engineering decided to continue studying in graduate institutions despite the lure of an easy job market and the unprecedented high level of salaries now being offered to graduate engineers.

The survey, conducted by Prof. Herbert F. Roemmele, industrial relations officer and dean of students, showed that the remainder of the graduates from the Day Session of the School of Engineering received starting salaries averaging $360 a month, or $4,320 a year—an increase of 11 percent over last year's average. In the Evening Session graduating group, all of whom were employed during their attendance at the school, he found an average salary of $5,712—an increase of 10 percent over last year's average for a similar group. Several members of the class were earning as much as $8,700 per year.

As an indication of the growing demand for engineers, Professor Roemmele pointed out that during the past year there has been an increase of more than 28 percent in the number of personnel officers from engineering firms visiting the Cooper Union to interview graduating seniors.

Prestressing Reduces Cost of Belgian Hangar Project

Belgian airplane hangar recently completed in Brussels provides an area 502 ft wide by 216 ft deep. The main feature of the steel roof is a single prestressed-steel truss, unique in design, having two equal spans of 251 ft. It is prestressed with two sets of 64-wire, high-strength steel cables, one set anchored at each of the lower ends of the truss, and extending over the central support, to terminate at about the third point of the other span. According to Prof. Gustave Magnel, M. ASCE, who designed the hangar and developed the theory, a conventional truss would have cost 7.5 percent more at the present price of structural steel and steel wire in Belgium. The prestressed truss supports secondary trusses, which span 161 ft from the back-wall columns of the hangar and cantilever 55 ft beyond it to the door opening, thus providing 2½ acres of floor space with but one intermediate support.

New York City to Have Large Convention Hall

Redevelopment of part of the Columbus Circle area in New York as a combined convention hall and apartment house project will get under way following recent acquisition of the site by the city. The Triborough Bridge and Tunnel Authority, which will be in charge of the project for the city, has contracted with the architectural firm of Leon and Lionel Levy for the preparation of detailed plans and specifications for the "Coliseum," as the project will be called. Many different studies of the facade of the building have already been prepared and are being considered by an Advisory Committee employed by the Authority.

A proposed sports arena portion of the project was dropped more than a year ago when it was decided that the westerly half of the two-block area would be used as the site of a new apartment development. The Coliseum itself will consist primarily of a large convention hall to house business shows and commercial exhibits, many of which have been bypassing New York because of the inadequacy of its accommodations. The project will also include a large parking garage to accommodate visitors to the hall and relieve the traffic problem in the area. Stores and other features required to make the project financially sound will be decided upon later.

Completion of the building is scheduled for the fall of 1956.

Federal-State Highway Relations Studied

Continuation of the long-range highway program developed by state and local governments with federal aid is advocated by the Chamber of Commerce of the United States in a report entitled *Highway Construction—Federal-State Relations*, published by its Construction and Civic Development Department. Recognizing that, without federal aid, "each of the 48 states might well have built an independent highway system, giving little thought to neighboring states and resulting in a hodgepodge highway network with duplication of facilities and serious inadequacies," the report primarily makes available background information on the role of the government in the nation's highway program.

The Chamber of Commerce policy in the field calls for administration of all federal aid for highways by a single federal agency working through the state highway departments. "Allotments of federal aid among the states," it says, "should be confined to the roads used primarily by traffic in interstate commerce, and should, among other factors, give adequate consideration to traffic volume and needs thereon." Matching of federal aid in not less than equal amounts by state funds should be required, the Chamber of Commerce concludes.

Total federal-aid highway authorizations for the fiscal years 1917 through 1955 come to $7,060,000,000. For comparative purposes, the appropriation for each fiscal year is given in the following tabulation:

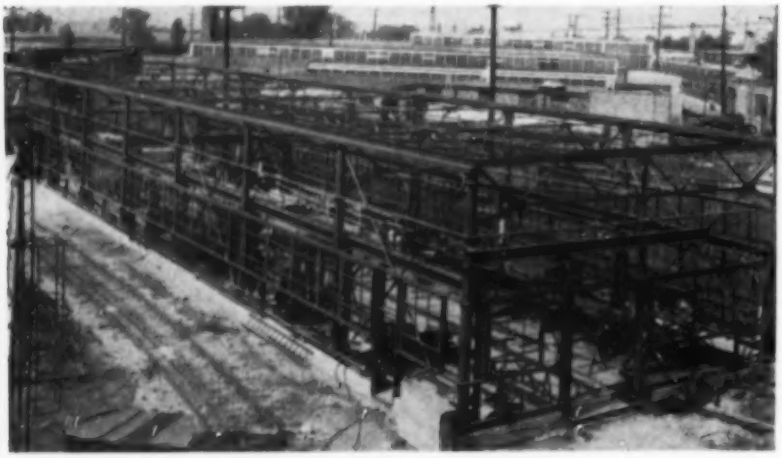
Fiscal Year	Total	Fiscal Year	Total
1917	$ 5,000,000	1937	$125,000,000
1918	10,000,000	1938	200,000,000
1919	65,000,000	1939	200,000,000
1920	95,000,000	1940	135,000,000
1921	100,000,000	1941	160,000,000
1922	75,000,000	1942	137,500,000
1923	50,000,000	1943	137,500,000
1924	62,000,000	1944	....
1925	75,000,000	1945	....
1926	75,000,000	1946	500,000,000
1927	75,000,000	1947	500,000,000
1928	75,000,000	1948	500,000,000
1929	75,000,000	1949	....
1930	75,000,000	1950	450,000,000
1931	125,000,000	1951	450,000,000
1932	125,000,000	1952	500,000,000
1933	125,000,000	1953	500,000,000
1934	....	1954	575,000,000
1935	....	1955	575,000,000
1936	125,000,000		

Copies of the study, priced at 10 cents each and $5 in bulk lots of 100, are obtainable from the Construction and Civic Development Department, Chamber of Commerce of the United States, Washington 6, D.C.

New York Opens Airlines Terminal and Parking Garage

Centralized terminal facilities for all buses serving the metropolitan airports were opened to the public on December 2, with dedication of the new East Side Airlines Terminal and Parking Garage in New York. Built for the city by the Triborough Bridge and Tunnel Authority at a total cost of $6,800,000, the project was designed to relieve traffic congestion in the vicinity of the central ticket offices on 42nd Street by taking the airlines buses off the streets. The terminal building consists of a street-level storage and maintenance garage for the buses; a main floor with a large central public waiting room surrounded by ticket counters and loading and unloading space for buses; and a mezzanine containing similar facilities for the foreign flag lines. The roof, reached by a ramp, is a public parking place with space for 275 cars. Located at 37th Street, near the Manhattan entrance to the Queens-Midtown Tunnel, the terminal is convenient to the arterial highway system extending from the tunnel to International and La Guardia airports. William Wilson, M. ASCE, was consultant on design and construction to the Triborough Bridge and Tunnel Authority, and S. S. Silberblatt, Inc., was general contractor on the project.

Company Uses Its Structural Pipe to Speed Plant Expansion



Faced with a sudden need for plant expansion, the L. B. Foster Company, manufacturer of steel sheetpiling, railroad trackage, structural pipe and of the Foster Portable Pier, a patented development, utilized its own pipe fabrication facilities and its own stocks of structural pipe to erect an addition to its Chicago plant. Construction of the addition, which is 160 ft long and 38 ft wide and provides about 6,000 sq ft of manufacturing space, required a month. Plans for a conventionally designed building using structural shapes were discarded when it was found that fabricated steel would not be available in time to permit completion of the building to meet production schedules. Standards 1 ½- to 9-in. steel pipe was used instead of structural shapes for all columns, trusses, joists, and bracing. Field erection bolts were used in the erection of the pipe frame to permit disassembly and re-erection of the building in another location, if desired. Corrugated siding was used for wall construction, and the roof is prefabricated steel roof decking.

Engineering Registration At M.I.T. Reported High

A total of 5,129 students registered for the opening of the current academic year at the Massachusetts Institute of Technology, according to figures just released by Joseph C. MacKinnon, M.I.T. registrar. This total, he said, represents an increase of 55 students over last year's registration. However, this year's entering class numbers 843, compared with 937 in the freshman class a year ago, and only this year's sophomore class is larger than the corresponding group of the 1952–1953 academic year. The tentative registration figure of 1,924 graduate students marks a new high in M.I.T. history.

The department of electrical engineering continues to have the largest enrollment, with a total of 1,003. The departments of mechanical and chemical engineering follow, with 602 and 553, respectively.

Alaska Defense Construction Is 70 Percent Complete

Approximately $550,000,000 in military defense construction has been turned over to the Army and the Air Force by the Alaska District of the Corps of Engineers since the Alaska District was established in 1946, and an estimated $238,000,000 in defense projects remains to be built under the Alaska defense construction program. These figures are released by Col. L. H. Foote, District Engineer, in a review of accomplishments and plans of the Alaska District.

Total construction to date, plus the proposed defense building for the remainder of the program, will amount to about $788,000,000, Colonel Foote said. Included in the overall total are $158,000,000 in projects now in various stages of construction, and $80,000,000 still to be let under contract for work on Army and Navy bases throughout Alaska. Not all the funds for the proposed construction have been authorized at this time, he said.

Chicago Bridge & Iron Co. Opens New Sales Office

Opening of a new Western sales office in Salt Lake City, Utah, on December 1, is announced by the Chicago Bridge & Iron Co. J. Graham Daniels, J. M. ASCE, has been transferred from Tulsa, Okla., to take charge of the new office. The company's other offices in the West are located in San Francisco, Los Angeles, and Seattle.

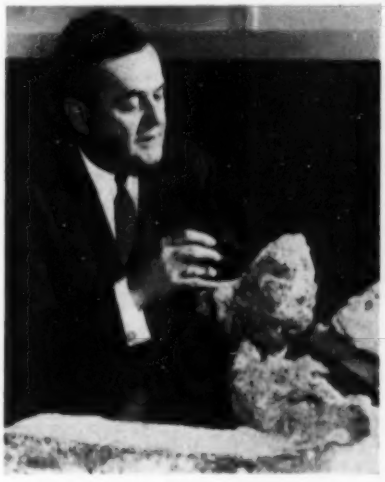
Sewage and Water Works Authorized by NPA in 1952

Data on water and sewerage construction authorized for major cities during 1952 by the National Production Authority have been made available in tabular form by the Water and Sewerage Industry and Utilities Division, one of 25 divisions in the recently established Business and Defense Services Administration, successor agency to the NPA.

During the period October 31, 1951, to December 31, 1952, the NPA authorized construction of water works totaling $510,367,000 in cities of 25,000 and over in the United States, Hawaii, and Puerto Rico. The number of individual projects was 221, and the average cost per project was $2,309,000. Sewage works authorized during the same period for cities of 25,000 population and over came to $516,353,000. There were 134 such projects, and the average cost per project was $3,854,000. Inquiries concerning the tabulations for the two types of works should be addressed to the Business and Defense Services Administration, Department of Commerce, Washington 25, D.C.

The Water and Sewerage Industry and Utilities Division will be made a clearing agency, through which water and sewerage problems can be viewed in proper perspective by both industry and the government. The Division will work extensively with other government departments, such as the Public Health Service and the Geological Survey.

Concrete Withstands Ravages of Twenty Centuries



Samples of 2,000-year-old concrete—still in serviceable condition—are displayed by Henry L. Kennedy, M. ASCE, president of the American Concrete Institute, who brought them to the United States from Italy. Believed to be the oldest known example of hydraulic concrete, the samples were taken from piers that once supported a large wharf in the Bay of Pozzuoli near Mt. Vesuvius. The wharf was built during the reign of the Roman Emperor Caius Caesar Caligula 12–41 A.D.), and the piers have been submerged since that time. Prior to discovery of the wharf it was believed that the ancients, who normally built such structures of masonry, had not learned the secret of making hydraulic concrete. According to Italian concrete technologists, who presented the samples to Mr. Kennedy during a recent trip abroad, Roman engineers probably discovered by accident that the volcanic ash from Mt. Vesuvius would react with lime to make a cement that would harden under water.

Fellowships in Jet Propulsion Available

In order to find and train outstanding men for basic research and leadership in the development of rockets and jet propulsion, the Daniel and Florence Guggenheim Foundation is awarding fellowships for graduate study at Guggenheim Jet Propulsion Centers at two universities—Princeton and the California Institute of Technology. A total of $18,000 in stipends is available at each institution. The fellowships have an annual value of from $1,000 to $2,000, plus tuition, for study toward advanced degrees.

The fellowships are open to college graduates with suitable engineering or scientific undergraduate preparation. Candidates must have outstanding technical ability, demonstrated qualities of leadership, and deep interest in the proposed field of study. Applications must be received by March 1, 1954, and will be acted upon by April 1. Descriptive booklets and application forms may be obtained from the Daniel and Florence Guggenheim Foundation, 120 Broadway, New York 5, N.Y.

High Construction Levels Forecast for 1954

Expenditures for new construction are expected to total about $34 billion, in 1954, slightly (2 percent) less than the record volume of nearly $34¾ billion evident for 1953, according to outlook estimates prepared jointly by the Building Materials and Construction Division of the U.S. Department of Commerce and the U.S. Labor Department's Bureau of Labor Statistics. Though the joint agencies foresee a mild contraction in private construction in the coming year, indications are that publicly financed activity will about equal this year's volume. It is estimated that private expenditures in 1954 will total $22.8 billion, and public outlays, $11.2 billion.

Private housing and industrial plant are expected to decline along with farm construction and defense facilities (public industrial and military installations). These decreases will be largely offset, however, because of extensive backlogs and constant pressure for the types of construction needed to serve the mobile and fast-growing population and the spreading suburban communities that have mushroomed since the war—utilities, stores, schools, churches, recreational facilities, and roads.

In assessing the prospects for construction activity in 1954, the two agencies have assumed no significant change in the international situation and continuing high levels of employment and personal income, but a slight easing in the general economy and some rise in unemployment. It was anticipated also that about a million new nonfarm dwelling units (including 25,000 public) will be started, that mortgage funds will be adequate, and that building costs will vary little from current levels.

Commercial, religious, and educational (public and private) building, as well as privately owned public utilities and highway construction, are all likely to reach an all-time high in dollar volume in 1954. Churches, schools, utilities, and highways should also set new records in terms of facilities actually put in place (expenditures adjusted for price changes), but physical volume in commercial building will be considerably under the amount installed during the flourishing nineteen twenties.

Essay Contest for Young Engineers Announced

"Why be an engineer," the Engineering Societies of New England ask in their current Journal. A good answer to this question, they say, may earn young engineers prize money and recognition in an essay contest. Eligible are all members of the ESNE who will not have reached their 30th birthday by March 1, 1954. The topic, "Why Study Engineering?" will have for its purpose acquainting qualified students of high school age and their teachers and parents, with the profession. There will be three prizes of $50, $30, and $20.

Detailed instructions on the contest, which will close March 1, will be available in a forthcoming issue of the Journal.

November Construction Expenditures Set Record for the Month

Expenditures for new construction declined less than seasonally in November to $3 billion, and both public and private activity were at new record levels for the month, according to preliminary estimates of the Building Materials and Construction Division of the U.S. Department of Commerce and the U.S. Labor Department's Bureau of Labor Statistics. Most major construction categories continued strong for the time of year, the joint agencies note, with commercial building showing a contra-seasonal rise to an all-time monthly high.

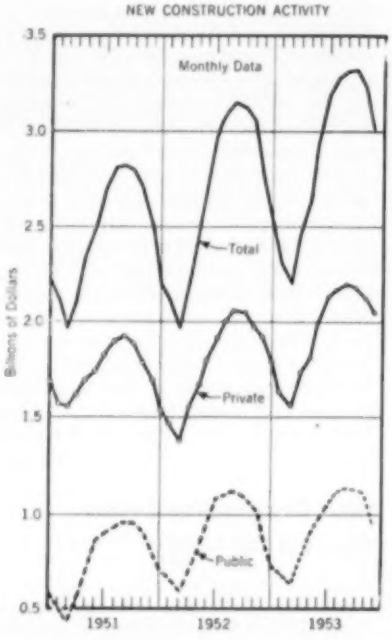
Private spending for residential building remained above the billion-dollar level for the seventh consecutive month, and was about the same as in November 1952. Dollar volume for the month was well under a year earlier for (public and private) industrial and hospital building, farm construction, public housing, military and naval facilities, and conservation and development work. These declines were more than offset, however, by gains in all other types of construction activity, including most kinds of non-residential building, public utilities, and road construction. Commercial building, especially, was substantially above the year-ago level, exceeding the November 1952 figure by more than two-thirds.

Total expenditures for new construction put in place during the first eleven months of 1953 amounted to $32.1 billion, a gain of 7 percent over the same 1952 period. Physical volume (expenditures adjusted for price changes) also was up from 1952, by about 3 percent.

Thus far in 1953, nearly $10 billion has been spent for new private non-farm housing—about 6 percent more than in the January-November 1952 period. Dollar outlays for home improvements in the form of additions and alterations were also up by 6 percent from last year, when the first eleven months are compared, while expenditures for non-housekeeping residential building (hotels, motels, and dormitories) were almost half again as great.

Following the establishment and growth of new communities, commerical, religious, and educational (public and private) building, as well as privately owned public utilities, highways, and sewer and water facilities, each rose substantially over the year, and each reached an all-time high in terms of dollar volume for the January-November period.

Private spending for industrial plant expansion was just a little below the record 1952 total for the first eleven months, and public outlays for industrial building (including atomic energy facilities) were 8 percent higher. Construction of military and naval facilities nearly equaled last year's January-November volume, which was a postwar high. On the other hand, public housing was down by 15 percent, and hospital building (public and private combined) decreased 23 percent, reflecting the decline in federally aided or subsidized programs, and the completion of veterans' hospital buildings.



Construction expenditures decline less than seasonally in November to $3,000,000 total—an all-time high for the month—as shown in Department of Commerce curves.

Sanitary Clean-Up of Ohio Valley Reported

Cleaner streams in the Ohio River Valley are fast becoming a reality, according to the fifth annual report of the Ohio River Valley Water Sanitation Commission, presented to the governors of the states in the Valley on December 1. The states are signatories to a compact, as a result of which the Commission was established in 1948 to coordinate a regional campaign of river clean-up.

The record for municipalities in the Ohio Valley shows that 43 percent of the sewered population of 9,320,000 is now receiving some form of treatment. During the past year 74 sewage treatment plants or additions to plants, serving a population of almost 800,000, were either placed in operation or under construction. Equally impressive, the report notes, is the status of industrial-waste installations, which show that two-thirds of the industries discharging directly into the streams of the basin are now operating control facilities.

"Five years is a short time in a campaign of interstate pollution control when we consider the problem has been more than fifty years in the making," said Edward J. Cleary, M. ASCE, executive director of the Commission, in the report to the governors. None the less, he asserted "in this brief period, new pollution has been curbed, existing pollution is being decreased, and the trend of half a century has been reversed."

Copies of the report may be obtained from the Commission at 414 Walnut Street, Cincinnati 2, Ohio.

Work Progresses on Santa Ana-Hollywood Freeway

Aerial view of Santa Ana-Hollywood Freeway, part of the Los Angeles Freeway System under construction, shows heavy traffic using detours around site for Alameda Street grade separation. In the background there is a four-level interchange structure, with Harbor Freeway extending to the left and Arroyo Seco Parkway to the right. Sixty construction contracts have been awarded for the 32-mile route that extends between the Los Angeles Civic Center (foreground) and Santa Ana. Expenditures for rights of way and construction are over $45,000,000 to date. With one minor exception, the route will be opened all the way from Los Angeles to and through the City of Santa Ana in early 1954. Photo courtesy "California Highways and Public Works."

Mobile Soils Lab Expedites Construction Projects

A single answer to many construction control problems—such as loss of time in getting soil samples to a central laboratory and in awaiting reports on them; loss of moisture content attending the transportation of samples; and the expense of all the steps involved in sample shipping—is found in a single piece of equipment, a mobile soil-testing laboratory.

In this laboratory, manufactured by Soiltest, Inc., of Chicago, and called Mobilab, the engineer can perform standard soil tests for grain size, liquid limit, plastic limit, shrinkage limit, specific gravity, compaction, field testing, California Bearing Ratio, unconfined compression, load bearing, and permeability. (Special units can be equipped for consolidation and triaxial testing of soils or for tests of asphalt, bituminous materials, and concrete.) He can be at the job site and in the lab at the same time, and he can cover several jobs during the work week. He can test samples at the point of extraction and, in some cases, run simultaneous lab and field tests for comparative results.

The van panel body is insulated with 2 in. of Fiberglas on the sides and 1 in. on the top. It has a finished plywood interior 12 ft long, 7 ft wide, and 6 ft 8 in. high, which is lighted and ventilated. It contains its own compressor system for operating the 100-gal washwater, and the 25-gal distilled-water tanks. Other equipment includes a vacuum pump and an electric generator set which supplies the six double outlets, and lights the laboratory independently of the truck-lighting system. Mobility is provided by the latest Ford F-600, two-ton, 106-hp V-8, with a 154-in. wheelbase and a gross vehicle weight of 16,000 lb without equipment. On the right side there is a S.A.S. 6-v power take-off.

Material from which this item was prepared was provided by M. D. Morris, A.M. ASCE, Eastern representative of Soiltest, Inc.

Mobile soils laboratory can be working part of a construction job, saving engineer's time and helping to improve quality of finished product. Postwar Japan was among the first to put to practical use the development of such a laboratory.

New Swiss Tripod Expedites Surveying

To do away with all the unnecessary manipulations around the transit with an optical plummet, the Kern Company of Aarau, Switzerland, in business since 1819, has developed a so-called tilting plate tripod. This tripod has a plate, mounted on gimbals, built into the head. The plate which serves as a base for the instrument, can be leveled by means of a set of tiny cross-levels countersunk into its surface, and secured by three small locking screws. This gives the transitman a sufficiently horizontal surface on which to shift his instrument around so that the small amount of fine leveling which may be necessary (due to the difference in sensitivity between the small cross levels of the tripod head and the plate level of the theodolite) will not throw the instrument off the station point. With the tilting plate tripod, the only difficulty is in setting it up close enough over the point so that the lateral play is sufficient to center the instrument.

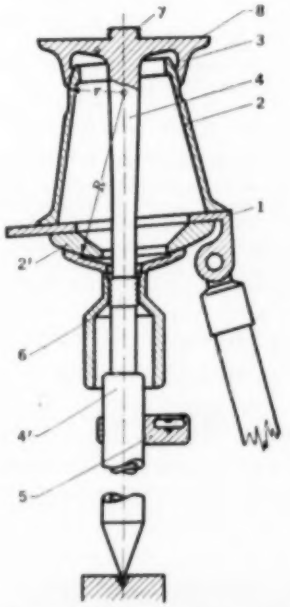
The Centering Tripod does three things for the surveyor, simultaneously, simply, and fast:

1. It centers the instrument over the station point, mechanically (not optically; the optical plummet is not used), and in a matter of seconds, with an accuracy of 0.02 to 0.04 in.

2. It roughly levels the top of the tripod head, within 2 to 3 minutes of arc, automatically.

3. It is calibrated to show the height of instrument (H.I.) automatically—that is, the height from the station point to the horizontal axis of the theodolite with a range from 3.8 to 6.0 ft. This is particularly convenient for topographic work.

The Centering Tripod is basically a ball-and-socket head tripod, with a centering device. The tripod head (2 and 2′) has two spherical surfaces (r, R) with different radii, but the same center of curvature. The upper and lower spherical surfaces are separated and mounted in such a manner that the head can be shifted horizontally in all directions on the stationary tripod plate (1). The upper spherical surface (shorter radius) carries the movable support plate (3) with a bayonet type safety lock (7) and a centering sleeve for the instrument. A rigid shank (4) reaches downward from the support plate (3) through the tripod head and is connected, at its lower end, with a bowl-shaped clamping plate and a tightening sleeve (6), which rests against the lower (longer radius) surface (2′) of the tripod head. The continuation of the extension shank is a telescopic centering rod (4′) with an adjustable "bull's-eye" level. The centering rod is graduated in twentieths of a foot for direct reading of the instrument height. When the clamp (6) is tightened, the support plate (3) is pressed to the tripod head (2 and 2′) which in turn is pressed against the tripod plate (1), so that these parts together form a stable unit. Since the support plate is rigidly connected at right angles to the centering rod, and the centering sleeve on top (7) is concentric to the tip of the centering rod, a theodolite when placed in position is both roughly leveled and accurately centered as soon as the tip of the centering rod is placed on the station point and the circular level (5) is centered. When the nature of the terrain makes it necessary, the centering rod can be unscrewed. In that case the optical plummet or a plumb bob can be used.



Centering Tripod is basically a ball-and-socket tripod, with a centering device. The explanation of its operation is given in the item.

A further advantage of both the Tilting Plate and the Centering Tripods is that the long footscrews of the transits, subject to bending and wear, can be eliminated since the rough leveling is done by the tripod head. On Kern Theodolites they are replaced by three leveling knobs. These knobs, mounted on the side of the base, with their axes pointing to the center of the instrument have a spiral groove, so that when the knob is turned, the cam (and that particular side of the instrument) is lifted or lowered, depending upon the direction of the turn. This gives the instrument greater stability and does away with another classical hazard.

Paul Reinhart Co., Inc., 66 Beaver St., New York 4, N.Y., is agent for the tripods in this country.

Most of Ohio Turnpike Is Under Construction

The entire 241-mile length of the Ohio Turnpike is either under construction or has been advertised for letting, with the exception of a four-mile section that includes the route through the northern edge of the city of Elyria. Although it had been expected that the entire project would be under contract by the end of 1953, so that construction could proceed without delay, the Ohio Turnpike Commission has had to postpone advertising for bids for construction of the Elyria section, pending efforts to reach an agreement with the city which is opposing location of the project.

Contract Awarded for Duwamish River Bridge

Award of a contract to the General Construction Co., of Seattle, Wash., for construction of the first unit of a new crossing of the Duwamish River in Seattle is announced by the Washington State Highway Commission. The amount of the contract for this first unit is $1,387,655. The estimated cost of the bridge is $6,500,000.

The present contract involves the construction of partially supported cellular piers that will form the foundation for a four-lane steel bascule structure, to be constructed under a subsequent contract. The cellular piers are designed to provide a buoyant effect that will offset the difference between the safe carrying capacity of the foundation material and the total dead and live load of the structure.

Contracts Awarded for Turnpike Extension Job

Work on the Newark Bay-Hudson County extension of the New Jersey Turnpike will proceed, following award of contracts totaling $6,690,390, to the lowest bidders, according to an announcement from the New Jersey Turnpike Authority. The Merritt-Chapman & Scott Corp., of New York, received two contracts—one for $1,876,600 for furnishing west approach land piers for the Newark Bay crossing of the extension, and the other (at $879,540) for the east approach land piers. The Dravo Corp., of Pittsburgh, was awarded a contract in the amount of $3,934,250 to construct the river piers for the Newark Bay Bridge.

The contracts are the first to be awarded on the Turnpike extension project, which will connect to the Newark Airport interchange, cross Newark Bay into Bayonne and Jersey City, and provide direct access to the Holland Tunnel. The project is designed to provide traffic relief for overcrowded Hudson County and to reduce travel time between Jersey City, Bayonne, and Newark, and lower Manhattan.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Happy New Year," mumbled the Professor, as if he didn't mean it or was thinking of something else.

Joe Kerr knew. "Stop wondering," he said, "whether you fooled me with your cubical measuring tank. You didn't. From a tabulation of your data:

H	T	V	$\Delta T/\Delta H$	$\Delta V/\Delta H$
0	0	0		
			4	12
4	16	48		
			21	63
7	79	237		
			38.3	115
10	194	582		

where H is the stage and V the volume in the tank after T sec, I thot at first the tank was leaking, at a rate increasing with the stage. But the last column shows there could be the same retardation effect if the tank was a cube on the outside and a bin or hopper on the inside. I fit the data with

$$V = \frac{1}{210}(29H^3 + 1{,}211H^2 - 2{,}788H) \quad . . (1)$$

$$A = dV/dH = \frac{1}{210}(87H^2 + 2{,}422H - 2{,}788) \quad . . (2)$$

Then from (2), when $H = 10$, $A = 143.5$, so I suppose the water had nearly reached the top of the hopper bottom in a 12-ft cube. It would take 96 sec more to fill the 287 or 288 cu ft up to $H = 12$, so the total time was 290 sec."

"Joe really made a nice try," conceded Cal Klater, "but he overlooked the negative values of V and A for small H. He also overlooked Professor Neare's deliberate oversight in not specifying a plumb tank. So I say the cube was cockeyed to the second degree, for which the liquid contents are:

$$V = \frac{s^2}{6ab}[H^3 - (H-a)^3 - (H-b)^3 + (H-a-b)^3] \quad . . (3)$$

where s is the edge of the cube, H is the slope stage along an edge from the bottom corner, and $H = a$, b, and $a + b$ when the other bottom corners are awash, it being understood that negative terms are to be ignored. Now if $H = 4 > a$,

$$48 = \frac{s^2}{6ab} \cdot 4^3 \quad . . . . . (4)$$

and $s^2/6ab = 3/4$. Then if $H = 7$ is between a and b,

$$237 = {}^3/_4[7^3 - (7-a)^3] \quad . . . (5)$$

and $a = 4$. Finally if $H = 10$ is between b and $a + b$,

$$582 = {}^3/_4[10^3 - (10-4)^3 - (10-b)^3] \quad . . (6)$$

and $b = 8$. So $s^2 = {}^3/_4 \cdot 6 \cdot 4 \cdot 8 = 144$ and $s = 12$, making the volume of the cube 1,728, which would take 576 sec to fill."

"You forgot it was cockeyed and uncovered," sniped Joe.

"Oh, oh," blushed Cal. "With $a + b = 12 = s$, the tank would overflow when half full, or when $T = 288$ sec."

"I was nearer," crowed Joe.

"Let's all laugh," suggested the Professor, "and try a new one with smaller numbers and a bigger name, like the isoscelezium. Jim Nast has one in his rumpus room. It's a trapeze with a 3-ft cross-bar on 3-ft rope suspenders hung from ceiling hooks 6 ft apart, forming an isosceles trapezium. When Jim hangs on one end of the cross-bar and his father weighing three times as much hangs from the other end, how much higher is his end than his dad's?"

[*Unblushing Cal Klaters were: Flo Ridan* (*Charles G. Edson*), *Ignor Antinuff* (*Paul Hartman*), *Stoop* (*John L.*) *Nagle, Don'T* (*Donald Thayer*), *and Sauer Doe* (*Marvin Larson*).]

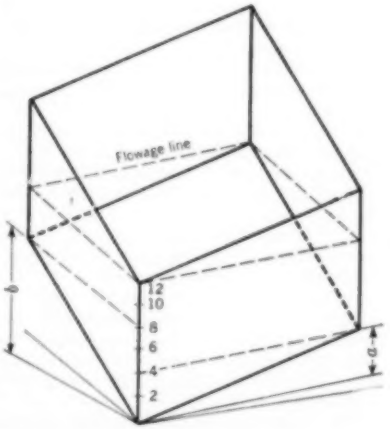
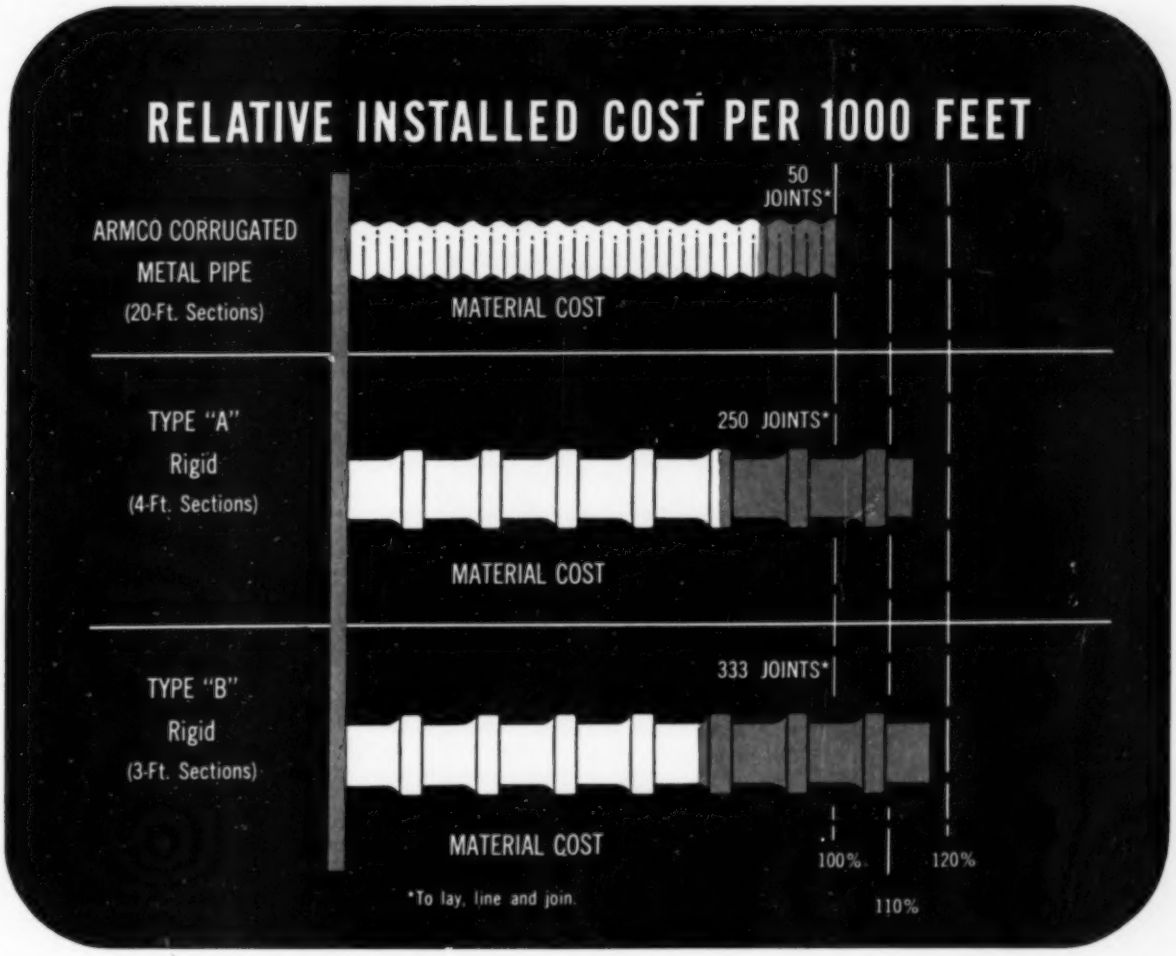


FIG. 1. Cal calibrated the cockeyed cube to overflow when half full.



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Armco Corrugated Metal Pipe is supplied in diameters from 8 to 96 inches. Lengths range up to 24 feet. Bituminous coatings or ASBESTOS-BONDED Pipe protect against severe corrosion.
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Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO DRAINAGE STRUCTURES

DECEASED

James Wadsworth Armstrong (M. '11), age 85, former filtration engineer with the Baltimore City Water Department, died on October 20, at Bradenton, Fla., where he had been residing since his retirement in 1937. Mr. Armstrong had been with the water department for 25 years. Earlier he was associated with Hering & Fuller, of New York City, and with the Sewerage and Water Board of New Orleans.

Norman Collyer (M. '18), age 72, consultant to Paramount Pictures, Inc., New York, N.Y., since his retirement several years ago from active duties as assistant secretary, died in New York, on October 16. He had been continuously connected with the organization since 1920. A civil engineering graduate of Stanford University, Mr. Collyer originated and directed the student system of the Southern Pacific Railroad, and served as director of the government program for the "training and education of drafted men" during World War I.

Thomas Marsh Davis (M. '51), age 71, who retired in 1951 as district engineer for the U.S. Bureau of Public Roads at Portland, Oreg., following 34 years of service, died at his home in Portland on October 23. Earlier (1913 to 1917) Mr. Davis was with the Oregon State Highway Department, and he had been highway engineer for Klickitat County (Washington). He attended the Armour Institute of Technology.

Howard Augustus Fitch (M. '06), age 85, president and founder (1907) of the Kansas City Structural Steel Co., Kansas City, Kans., died on November 2. Prior to the organization of his company, Mr. Fitch was employed by the Gillette Herzog Manufacturing Co., and the Minneapolis Steel & Machinery Co., of Minneapolis, Minn., and the King Bridge Co., Cleveland, Ohio.

John Laurens Guest (M. '50), age 54, since 1945 consulting engineer and head of John L. Guest & Associates, of Richmond, Va., died in that city on January 28, 1953. Before settling in Richmond in 1932 Mr. Guest worked in Canada for the Duke-Price Power Co., and the Aluminum Company of Canada. In Richmond he was successively employed as an engineer by the Virginia Steel Co.; J. Binford Walford, Architect; the Wise Contracting Co.; and the State Department of Education. He was an alumnus of Virginia Military Institute and Cornell University.

Williams Rutherford Hutchins (A.M. '30), age 66, head of Williams R. Hutchins, Phoenix (Ariz.) firm, died at his home in that city on October 10. A graduate of the University of Georgia, Mr. Hutchins served in the Arizona State Highway Department as district engineer for 14 years and was state highway engineer from 1939 to 1944.

Leroy Francis Harza (M. '17), age 71, president of the Harza Engineering Co., Chicago, Ill., died at his home in Highland Park, Ill., on November 22. A specialist in hydroelectric problems, Mr. Harza had been connected as a consulting engineer with the investigation, design, and construction of dams, hydraulic works, and hydroelectric projects all over the world. These projects included the Santee-Cooper

Leroy F. Harza

power and navigation project, the Fort Peck Dam powerhouse, and the Loup River (Nebraska) Public Power project. He was United States delegate to the World Power Conference in Berlin (in 1930) and to the Fourth Congress on Large Dams in Bombay in 1951. Mr. Harza was an alumnus of South Dakota State College and the University of Wisconsin. Author of many technical articles, Mr. Harza won the Society's J. James R. Croes Medal in 1950.

Spencer Ainsworth Jones (A.M. '45), age 63, consulting engineer of Palo Alto, Calif., died in Stockton, Calif., on June 2. Before entering private practice in 1938, Mr. Jones was employed as a designer and superintendent of construction by C. G. Jones, Architect, New York, N.Y., and the Grasselli Chemical Co., Cleveland, Ohio. For several years he was in the field of engineering advertising. Mr. Jones studied at Princeton University.

William Walter Lane (M. '27), age 64, since 1942 consulting engineer and head of Lane & Leeson, Phoenix, Ariz., died at his home in that city on November 4. Engaged in Arizona state service for many years, Mr. Lane held the posts of county engineer and chief engineer for the Pinal County Highway Commission; deputy state engineer, chief engineer, and state highway engineer for the Arizona Highway Department; and (since 1949) state land and water commissioner. He was also president and general manager of the Maricopa Reservoir and Power Co. He attended Kentucky Wesleyan College and Kentucky State College.

Ojus Malphurs (A.M. '45), age 49, structural engineer with the Corps of Engineers at Norfolk, Va., died on December 29, 1952. In government service since 1932, Mr. Malphurs had been with the U.S. Coast and Geodetic Survey and the Tennessee Valley Authority—as assistant and associate structural engineer on the Guntersville and Watts Bar dams, and office engineer on Ocoee No. 3 and Fontana dams. Earlier, he was with Knight, Bush & Thompson, of Monroe, N.Y., and Dwight P. Robinson & Co., of New York, N.Y. He was a graduate of the University of Florida.

Stephen Wood McClave, Jr. (M. '15), age 73, consulting engineer and a member of the engineering firm, McClave & McClave of Cliffside Park, N.J., died at his home in Englewood, N.J., on November 24. Mr. McClave attended Trinity College and was graduated in 1903 from Princeton University. Mr. McClave's firm, which he formed in partnership with his brother in 1907, was engaged on design of the approaches for the George Washington Bridge and the Lincoln Tunnel and closely identified with major engineering projects in Bergen County.

Wilfred Gillette McConnel (M. '03), age 84, retired engineer of Stamford, Conn., died at his home there on November 22. A resident of Brazil, Cuba, and Mexico for many years, Mr. McConnel had been general manager and chief engineer of the Cuba Eastern Railroad, the Rio de Janeiro Tramway, Light and Power Co., the Sao Paulo Tramway, Light and Power Co., and construction superintendent for the Mexican Light and Power Co., at Necaxa, and the Brazil Hydroelectric Co., at the Isla de Pombas. Returning to the United States in 1923, Mr. McConnel was engaged on public utility and industrial plant investigation and reporting, and later was with the PWA and FWA in the south Alabama area. He retired in 1944.

William Stanton Monroe (M. '25), age 85, former president of Sargent & Lundy, Chicago (Ill.) construction engineers specializing in electric power projects, died in September 1953. Mr. Monroe joined Sargent & Lundy in 1900 as chief draftsman, was made a member of the firm in 1911, and upon Mr. Sargent's death in 1919 became president—a post he held until his retirement in 1939. He was an alumnus of Cornell University.

Ray Murray (M. '39), age 77, retired engineer of Blue Ridge Summit, Pa., died recently. After graduating from the Massachusetts Institute of Technology in 1901, Mr. Murray was employed for six years by the American Bridge Co., and the Virginia Bridge & Iron Co. In 1909 he joined the Seaboard Construction Co., advancing to engineer and manager in 35 years of continuous service. He was next engaged as a contracting engineer on railroad bridge work with offices at Moylan and Blue Ridge Summit, Pa.

Albert Roy Olds (M. '19), age 71, since 1949 owner of ARO Equipment Co., Oakland, Calif., died several months ago. Mr. Olds was manager and then secretary of the Industrial Equipment Co., Oakland, for more than ten years before establishing his own business. From 1909 to 1919 he was connected with the Havana (Cuba)

(*Continued on page 92*)

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W & L E Gurley, America's Oldest Engineering Instrument Maker

Gurley Transits Set Gold Cup Course

"Men behind the buoys": Phil Bessor (with chart) and BMC Lester Green discuss course. Bessor says: "We especially appreciated the Gurleys on mile shots where accuracy was the same as at 500 ft."

"For three consecutive years now, the accuracy of the Gold Cup Regatta course has depended upon Gurley transits," reports Phil S. Bessor, Registered Engineer and Land Surveyor of Bellevue, Washington. "In 1951, '52, and again in '53, we were commissioned to design and lay out the race course on Lake Washington, Seattle. In '53, the course was 3¾ statute miles.

"Long before the buoys were set, there were many technical problems to be solved. The course had to be drawn and approved by the American Power Boat Association in Detroit. Curves had to be far enough from shore to prevent spectator mishaps. Naturally, we also kept in mind the best possible course for spectator viewing—as well as location of underwater cables, bridge clearances and the like.

"The Coast Guard tender *Rhododendron* worked with us in setting the 22 marker buoys which were anchored by 1450-pound iron balls. We used walkie-talkie communication between ground-based transitmen and the buoy placers aboard ship.

"Four feet starboard...two feet to port": transitman walkie-talkies instructions for laying buoys to tender. Even in fog, buoys were easily spotted with Gurleys.

"All buoys were set by triangulation, using three Gurleys—two transits on the Seattle shore line, a third on Mercer Island. All points were USC&GS monuments. Some were set as far back as 1901, so they were rerun and checked. Some shots were as great as 7300 feet, and set-ups were as long as nine and one-half hours at a stretch. We worked in hot and cold weather, wet and dry—with water as deep as 378 feet.

"On the morning of the big day, we set up again, and checked once more to make sure the buoys were still on line. We saw the race only through our transits, since we checked constantly to see if the markers had moved. After the race, the course was again checked for the official report.

"With the great accuracy required, the long distance shots, the time and weather and many other elements, I was glad to have Gurley transits on the job, just as I was when first using a Gurley 23 years ago."

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Many surveyors have asked us if it is possible to trade in an old transit or level on a new Gurley instrument. We will be pleased to receive your serial number and a brief description of your present instrument. Our answer by return mail will give details of our offer in your case.

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In the theatre of construction, Naylor light-weight pipe is constantly proving its performance ability. Take this scene from the building of the New York Thruway showing a line of 8-inch Naylor pipe feeding air to rock drills. Despite the constant battering from flying rock and the terrific impact of a fallen tree, there's no interruption in the lines and the show goes on. If this is the kind of performance you need for your jobs, write for Bulletin No. 507 and get the complete story.

NAYLOR PIPE

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Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Deceased

(*Continued from page 90*)

Electric Railway Co. He studied at the University of Wisconsin.

Erdis Robinson (M. '09), age 81, retired engineer of Columbus, Ohio, died on October 13. He was a member of the 1893 graduating class of Ohio State University. From 1902 until 1948, Mr. Robinson was president of a Columbus manufacturing firm, the Robinson Houchin Optical Company (previously called S. W. Robinson & Sons and the Robinson Optical Co.).

Elmer Frederick Schmoll (M. '53), age 58, structural engineer for the Pennsylvania Power & Light Co., at Allentown, Pa., died at Bethlehem, on October 15. Mr. Schmoll had been continuously connected with the utility company since 1920 supervising engineering on all structures built on its property. He was a civil engineering graduate of Lehigh University, class of 1916.

Forrest Leigh Smith (M. '09), age 73, member of the firm, Mason & Smith, of Perth Amboy, N.J., died on April 1, 1953. Engaged in private practice since 1901, Mr. Smith was one of the founders of Mason & Smith in 1904. At various periods he held the civic posts of township engineer for Woodbridge, N.J.; city engineer for Perth Amboy; and engineer for the boroughs of South River and Metuchen, N.J. He was an alumnus of the Cooper Union.

John Little Starkie (M. '28), age 69, retired railroad engineer, died in Fort Worth, Tex., on October 11. Mr. Starkie had worked for the Santa Fe Railway system for 38 years in Mexico, Kansas, Oklahoma, and Texas. He retired in 1950.

Achille Octave Van Suetendael (M. '16), age 70, a member of the New York Stock Exchange and senior member of the stock brokerage firm bearing his name, died at his home in Yonkers, N.Y., on November 18. Prior to 1932, when he entered the investment and securities field, Mr. Van Suetendael worked as an architect-engineer in New York City and Puerto Rico, and served as chief structural engineer in the New York State Department of Architecture from 1908 to 1917. He held degrees from Cooper Union, Columbia University and the New York Law School.

James Evert Wark (A.M. '36), age 50, for the past two years associate engineer with the Washington State Pollution Control Commission, Olympia, Wash., and a resident of Yakima, died in October. For several years Mr. Wark was structural engineer for the city of Detroit, and from 1935 to 1951 was associated with the firm of Ayres, Lewis, Norris and May, of Ann Arbor, Mich., as a partner from 1945 on. He was an alumnus of the University of Michigan, class of 1924.

Alfred Milnes Watson (M. '44), age 46, architect of Tampa, Fla., died at his home in that city on November 10. For several years Mr. Watson worked in Chicago, for Roberts & Schaefer Co., Universal Oil Products, Smith & Brown, Engineers,

S. S. Beman, Architect, and the Chicago Park District. In 1942 Mr. Watson moved to Tampa, where he was with McCloskey & Co., before starting his own practice. He graduated from the University of Michigan.

Henry Stanley Witulski (M. '50), age 58, structural engineer for Sanderson & Porter, New York, N.Y., died on October 29. During his career Mr. Witulski was employed as a structural designer by the Carleton Co., Inc., New York; Department of Public Works, Brooklyn Navy Yard; Bayonne Associates, Bayonne, N.J.; and the New York City Board of Water Supply. He was an alumnus of New York University.

NEWS OF ENGINEERS

Kingsley S. Andersson, commander of the Engineer Replacement Training Center, Fort Belvoir, Va., has been appointed chief of staff of the Engineer Center at Fort Belvoir. Colonel Andersson's appointment climaxes a 30-year military career as an engineering officer, several years of which have been spent at Fort Belvoir.

Cecil H. Barrett, for the past six years assistant chief engineer of the Pittsburgh (Pa.) Department of Public Works, has been named chief engineer to succeed the late **John D. Stevenson.** Mr. Barrett has been an employee of the City of Pittsburgh since 1922.

William D. Broyles resigned on December 1 from his position as designing engineer in the Humble Oil and Refining Company's refinery engineering division at Baytown, Tex., and is now engaged in a private engineering practice at 105A East Texas Ave., Baytown.

Harold A. Anderson has been elected vice-president and assistant general manager of the Austin Company, and will join the company's headquarters staff in Cleveland, Ohio, to work directly with the president on general planning and coordination. Connected with the Austin organization since 1928, Mr. Anderson has been vice-president and Eastern District manager since 1946. **W. G. Paton,** assistant secretary and vice-president in charge of the steel fabrication division and technical personnel in Cleveland, has been elected secretary and con-

Harold A. Anderson

(*Continued on page 94*)

BOARD OF PUBLIC AFFAIRS
MILLERSBURG, OHIO

June 24, 1953

Simplex Valve & Meter Co.
Philadelphia 42, Pa.

Gentlemen:

We have acquired a Simplex Venturi main line meter from the City of Wooster, Ohio. This meter was sold to City of Wooster on May 4, 1912.

We plan to install this meter on our main line at Millersburg, Ohio Water Plant. Will you please send us descriptive information and parts list for this meter.

Markings on identification plate are as follows:
8" Tube 4" Throat #8-43-548-G.D. MSD 38.187
May 4, 1912 Markings on Cover Plate #546

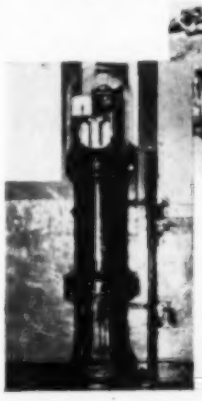
Address reply to: C. R. Deitrich, Supt. of W.W.

Respectfully,

C. R. Deitrich

C. R. Deitrich

Another proof that Simplex is reliable in the long run!



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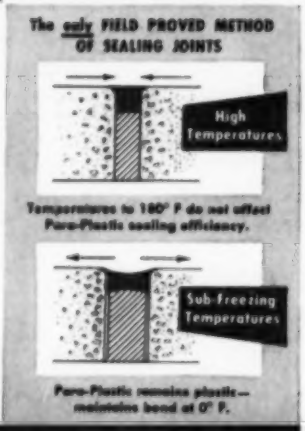
Use Hot Poured Para-Plastic . . . field-proved to be the only effective method of sealing joints with a high degree of permanence. There's no substitute for Para-Plastic . . . nothing equals its sealing performance. It's stable, constant in volume, won't break down and maintains bond under virtually every condition. Para-Plastic can now be pumped directly into the joint from the melting kettle—a fast, simple method of application. Write for details on new method and information on Para-Plastic and Para-Plastic JF.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TIDE GATES

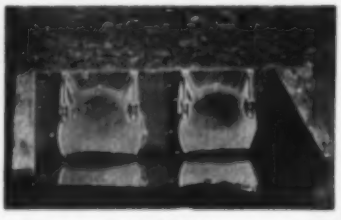

Fig. B-124-D
Two 60" Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

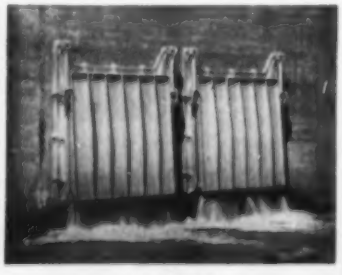

Fig. B-124-C
Two 72" x 72" Type M-M Gate on Toby Creek Outlet Works, Plymouth, Pa.

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News of Engineers

(*Continued from page 93*)

tinues as a vice-president. He joined the company in 1919 as a structural engineer.

A. D. Hunter, captain, CEC, USN, for the past four years deputy chief of the Bureau of Yards and Docks, in Washington, D.C., assumes new duties as commanding officer of the Naval Construction Battalion Center, Davisville, R.I., on January 5. In the service since his graduation from the U.S. Naval Academy in 1927, Captain Hunter has held assignments at naval bases in Washington, New York, Hawaii, Rhode Island, and Florida.

A. D. Hunter

E. Lawrence Chandler, assistant to the Secretary of ASCE at Society headquarters, has been elected president of the Brown Engineering Association, an alumni organization.

Robert A. W. Carleton, president and founder of the Carleton Company, Inc., New York construction engineering firm, has accepted the general chairmanship of the Columbia University Engineering Center Development Fund Committee, which is seeking to raise $22,150,000. Mr. Carleton is an alumnus of the School of Engineering, class of 1904.

Fletcher Graham is back with the Humble Oil Co. Installation Office, Houston, Tex., after twenty months at the Patrick Air Force Base in Cocoa, Fla.

Harry H. Stirman, director of Public Works for Corpus Christi, Tex., has accepted a similar position with the city of Dallas.

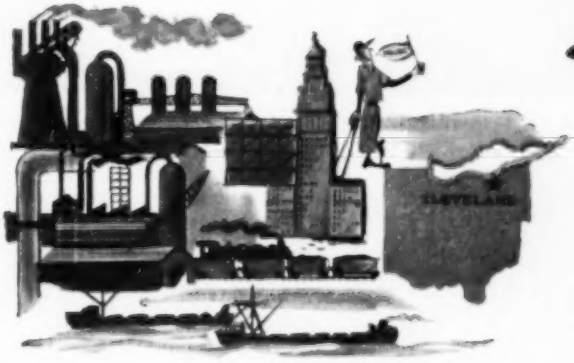
Maurice Parsons recently retired as special assistant to the Staff Public Works Officer, Naval Air Advanced Training Command, Corpus Christi Naval Air Station. Mr. Parsons is planning to go into private engineering practice after a brief rest.

James W. Darling recently purchased the W. P. Kelly surveying service—now known as the Kelly-Darling Surveying Co.—at Church and Maine Arcade, Orlando, Fla. Mr. Darling was formerly a civilian engineer in the Public Works Office of the 4th Naval District at its base in Philadelphia.

Herbert A. Davies, vice-president of the American Bridge Division of the U.S. Steel Corp., was honored by company officials at a banquet at Roanoke, Va., on October 30, upon his retirement after 50 years of service in the steel industry. Mr. Davies advanced

(*Continued on page 98*)

Cleveland Prefers Concrete Pressure Pipe



Economy was a decisive factor in Cleveland's selection of concrete pressure pipe for its water supply system. This seventh ranking city in the nation, with an average daily water consumption of 272 mgd., found that the low original cost of concrete pressure pipe, together with its remarkably long life and excellent flow characteristics, made it a sound investment.

In 1940 the first concrete pressure pipe was laid in Cleveland. Since that time several additional installations have been made, one of these being the Nottingham intake. Here, 10,000 feet of 120 inch concrete pressure pipe was used. Just recently the Northfield Road Main was completed. This job, stretching for over 4 miles, used concrete pressure pipe in diameters ranging from 30 to 42 inches.

Efficient, economical concrete pressure pipe is available in a wide range of diameters and can be installed to fit the individual requirements of large or small communities.

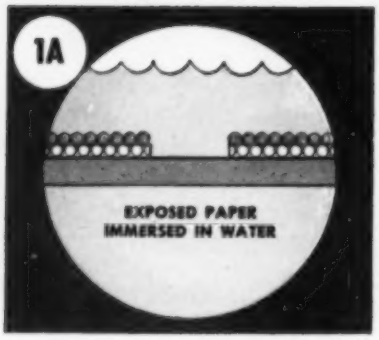
Water for Generations to come

Concrete PRESSURE Pipe

AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
228 North LaSalle Street
Chicago 1, Illinois

Why is a blueprint

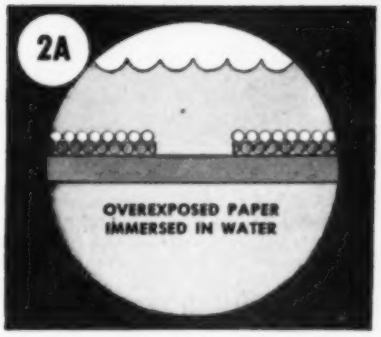
Simplified diagram of enlarged cross section of blueprint paper shows surface particles of the coating being struck by light. The coating, which is pale in color, contains two soluble ferric salts: a cyanide complex and an organic acid. Light reduces some of the ferric to ferrous ions in the exposed areas, producing a mixture of both. Opaque lines in a superimposed drawing prevent the light from reaching the coating beneath, as shown by the black bar in the center.



In the presence of water, the ferrous ions in the exposed areas react with the cyanide complex to form a ferrous-ferricyanide, which is Prussian Blue. (This is the famous blue pigment, insoluble in water, discovered in Berlin in 1704.) The areas that were shielded from light contain only the original soluble salts. These are washed away by the water, exposing the white paper beneath. The print then has white lines on a blue background.

Contrary to ordinary photographic processes, moderate overexposure of a blueprint has two good effects. It permits light to penetrate beneath the surface of the coating and thus to act in depth. It also reduces more of the surface salts from the ferric to ferrous condition, including the cyanide complex. But carried to an extreme, overexposure causes light to penetrate the opaque lines of a drawing with a resultant loss of contrast in the developed print.

BLUE?



When a moderately overexposed print is immersed in water, the ion mixtures react together. However, the colorless ferrous compounds that are formed on the surface of the coating cover up the layers beneath, and tend to hide the Prussian Blue color which has formed in the bottom layers. The print, at this stage, will have a grayish cast without full contrast.

Nearly every blueprinter, after washing the prints, immerses them in a solution of potassium dichromate, or peroxide. These are oxidizing agents that reverse the effect of too much light, changing a proportion of the ferrous ions back to ferric ions. In this way, with the help of overexposure, the entire thickness of the coating can be made effective in forming Prussian Blue. A deep, rich blue, contrasty print results.

● As one of the oldest reproduction processes, blueprinting has undergone little development until recent years. CHALLENGE* blueprint papers embody every valuable advance made in this time and, in addition, are produced with the extra skill and care that go into all K&E products. The presence of more colloidal Prussian Blue, plus a pre-coating process, enable CHALLENGE papers to provide more vivid white lines against a background of deeper, more intense blue.

Other outstanding K&E reproduction materials include HELIOS† dry developing diazo papers, cloths and films; ONYX* moist developing diazo papers; MADURO† brownprint papers and cloths; DUPRO† reproduction tracing cloth; and PHOTACT† reproduction papers, cloths and films. Ask your K&E Distributor or Branch for full information on what these various K&E reproduction materials can do for you.

*Trade Mark †Trade Mark®

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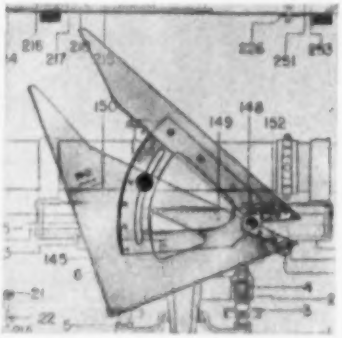


A triangle that gives you a straight edge that can be set at any angle! The TRI-TRACTOR*, basically a right triangle, also has a protractor element calibrated in half degrees. Its hypotenuse can be fixed at any desired angle with respect to the base line. Made of transparent plastic. Comes with 8" or 10" base.

K+E

News of Engineers

(*Continued from page 94*)

to the position of vice-president and general manager in 1946. When the Virginia and American bridge companies merged in 1952, he was named vice-president.

Bernard E. Gray was reelected president of the Asphalt Institute at its annual meeting held in New York City in the early part of December.

Arthur Monsey, former designer for Weiskopf & Pickworth, New York, N.Y., announces the opening of offices at 750 South Third West, Salt Lake City. A structural engineer, Mr. Monsey will specialize in designs, reports, and investigations of bridges, buildings, highways, airports and special structures. At the same time he has been appointed intermountain representative for Preload Engineers, Inc., of Arlington, Va.

S. S. Morris, city engineer of Capetown, Union of South Africa, has been elected president of the Institute of Municipal Engineers (South African District).

Lacey V. Murrow, executive director of the Association of American Railroads, Washington, D.C., has been named to the Water and Power Resources Task Force of the Hoover Commission.

Alfred E. Johnson, chief engineer of the Arkansas Highway Department (Little Rock, Ark.) since 1947, was elected president of the American Association of State Highway Officials at the association's 39th annual meeting in October. Active in AASHO affairs, Mr. Johnson previously served as first vice-president, regional vice-president and as a member of several committees. He has been continuously connected with the Arizona State Highway Department for 26 years.

R. P. LeBaron announces the formation of the LeBaron Construction Co., located at 40 West Louisiana, Denver 19, Colo. Until recently Mr. LeBaron was assistant manager of the Midwest Steel & Iron Works, and partner in Folsom & LeBaron, both of Denver.

William J. Lytle has been elected vice-president and appointed midwestern district manager of the W. E. O'Neil Construction Co., of Chicago and Syracuse. He was previously superintendent of construction for the R. C. Wieboldt Co., Chicago, Ill.

Lawrence P. Mains, professor of civil engineering at the Drexel Institute of Technology, has been named acting head of the department to succeed **Prof. Harry L. Bowman,** now dean of the College of Engineering and of the faculty.

Herbert D. Mendenhall announces the opening of an office for the practice of architecture and structural engineering at 718 West Pensacola St., Tallahassee, Fla. Colonel Mendenhall has been located in Tallahassee for several years, while serving with the Corps of Engineers.

Harold F. Smeed, district engineer of the federal Housing and Home Finance Agency, and chief of the New York and New England district, Albany, N.Y., retired on December 1, after 18 years in government service. Mr. Smeed will return to private engineering and construction work in the area.

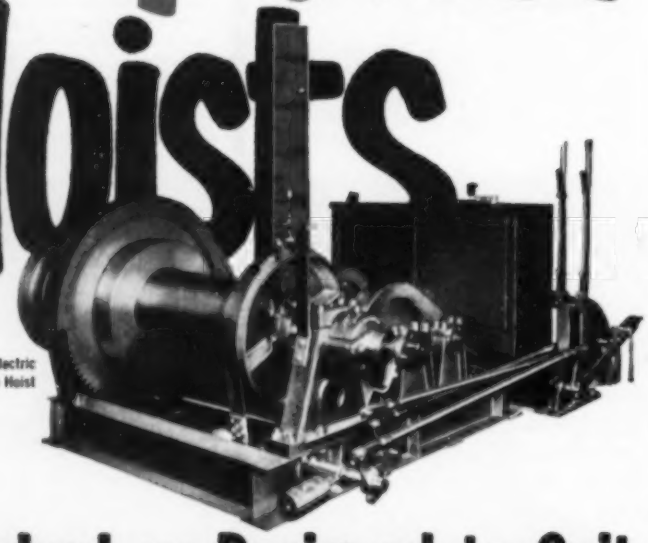
W. Jerome Strout has been promoted from chief engineer and mechanical superintendent to general manager of operations for the Bangor and Aroostook Railroad Co., at Bangor, Me. Connected with the company since 1926, Mr. Strout has been chief engineer since 1940, and chief engineer and mechanical superintendent since 1951.

Vito A. Vanoni, associate professor of hydraulics at the California Institute of Technology, has been honored by University of California civil engineering students who have elected him to membership "with special honor" in their chapter of Chi Epsilon—national civil engineering honor fraternity. He was cited "in recognition of his superior scholarship, character, practicality and sociability."

Daniel M. True, senior civil engineer for the Bureau of Engineering, City of Los Angeles, Calif., in charge of the Hollywood-Wilshire area, recently retired after more than 50 years in the bureau.

George D. Clyde, formerly assistant chief of operations in charge of engineering for the U.S. Soil Conservation Service at Logan, Utah, recently accepted a position with the State of Utah as Director of the Water and Power Board and Commissioner of Interstate Streams. His headquarters will be in Salt Lake City, Utah.

Superior Hoists



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Raymond A. Hill (above), member of the Los Angeles consulting firm, Leeds, Hill and Jewett, heads the board of consultants participating in a $500,000 study of the feasibility of a salt water barrier in San Francisco Bay. The group, named by the California Water Project Authority, includes Brig. Gen. Hans Kramer (retired), Sverdrup & Parcel, Inc., San Francisco; Malcolm Pirnie, senior member of Malcolm Pirnie, Engineers, New York; Philip C. Rutledge of Moran, Proctor, Mueser & Rutledge, New York; and Charles E. DeLeuw, president, DeLeuw, Cather & Co., Chicago.

H. H. Roberts has accepted the position of chief engineer for Brown & Root, Inc., Houston, Tex., on the Artibonite Valley project in Haiti. Mr. Roberts' most recent assignments include chief engineer, Construction Management & Engineering Associates, Paris, France, and project manager for the Arundel Corp., on Liberty Dam, Baltimore, Md.

Otto C. Rollman, consulting engineer of Green Bay, Wis., has been appointed chief engineer and administrative officer of the Wisconsin Turnpike Authority to head a $250,000 study to determine the feasibility of a $170,000,000 toll road across Wisconsin from Illinois to Minnesota.

Bennett L. Raffin, partner in the general contracting firm, Rothschild, Raffin & Weirick, San Francisco, has been selected one of the city's "News Makers of Tomorrow" by the Committee for San Francisco's Future. One hundred young professional and business men between the ages of 25 and 40 were selected by the committee, co-sponsored by the San Francisco Chamber of Commerce and *Time* magazine.

William W. Reedy has returned to his post as hydraulic engineer in the Hydrology Branch, Project Investigations Division of the U.S. Bureau of Reclamation at Denver, Colo., following a four-month leave, during which he was engaged in work for the Los Angeles consulting firm of Leeds, Hill and Jewett.

C. R. Sansbury, engineer for the Louisville (Ky.) District of the Corps of Engineers, retired recently and is planning to make his future home at Fort Myers, Fla.

Dewey S. Wright, formerly deputy city engineer, has taken over the duties of city engineer of the city and county of Denver, Colo., following the resignation of **Terrence J. Owens,** to join the Automotive Safety Foundation, Washington, D.C. **Clarence E. Harness,** who held the position of sanitary engineer for the city, becomes Mr. Wright's deputy. Mr. Wright has been in the city's engineering department since 1948.

George Winter, head of the department of structural engineering in the School of Civil Engineering at Cornell University, has been appointed to the American Concrete Institute's Standard Building Code Committee.

Morton O. Withey, emeritus dean of the University of Wisconsin College of Engineering, has been awarded the Citation of Merit of the Wisconsin Utilities Association for his outstanding service to the state, the university, and the engineering profession for almost half a century. The citation praises Dean Withey, who retired in July after 48 years on the faculty of the University of Wisconsin, for his researches in the application of materials for construction "which have influenced the progress of our times . . . , wise leadership as dean, and for his intellectual attainments . . . , good counsel, and patient guidance which have aided many students and young engineers."

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Pittsburgh plans to abate stream pollution . . .

(This article begins on page 44)

(Continued from page 47)

flash-drying incinerators. The multi-hearth design includes four furnaces having 12 hearths, each with an outside diameter of about 22 ft. The flash-drying design includes four complete units.

Coal, gas, or oil will be used depending on their economy as determined by their local cost, and by the bids to be received on the alternate designs of incinerator equipment. The availability of gas is uncertain under present conditions.

The saving in initial cost of this system of sludge disposal as compared with the conventional type, which involves digestion, elutriation, dewatering and incineration, is estimated at $4,000,000, with an annual overall saving of $50,000.

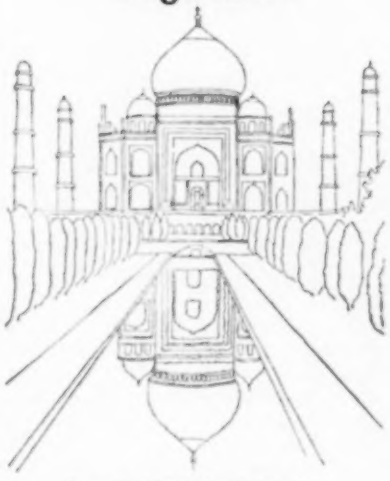
Metcalf & Eddy, consulting engineers of Boston, Mass., are designing the sewage treatment plant and the Chartiers Creek and Turtle Creek intercepting sewers, estimated to cost $27,000,000 at July 1953 prices. The Sanitary Authority staff is designing the major part of the intercepting sewers, estimated to cost $40,000,000.

The Sanitary Authority will complete its work early in 1954. Plans and specifications for approximately $52,000,000 of construction work are already in the hands of the Pennsylvania Department of Health for review and approval. After the state gives its approval to the Authority's plans and specifications, the city may exercise its option under an agreement between the Authority and the City of Pittsburgh of electing the Sanitary Authority to carry out the construction work or of appointing another sewage agency in its place.

Solution to problem on page 59

The contractor dug "French drains" to tidewater, as a result of which the pile heads were always covered with water and the piles were permanently preserved. It must be understood that the piles were surrounded by earth and they were capped with the masonry of the footings so that there was no danger of attack by marine borers.

The case of the disappearing engineer!



No sooner had the jungle site of the Taj Mahal been cleared, and large quantities of fill emplaced, than the design engineer disappeared. The Mogul Emperor, Shah Jahan, became so angered he threatened to cut off the head of his engineer as soon as he was found. Six months later the engineer walked into the Shah's palace and stated that he had been in hiding until the fill had settled and the marble mausoleum could be built on a firm foundation. He was forgiven, and the Taj Mahal was then constructed.

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This photograph shows the green walks on Bedloe's Island around the Statue of Liberty

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CIVIL ENGINEER; J.M. ASCE; M.C.E.; professional engineer; 31; married; teaching experience; 11 years' of diversified responsible experience in structural and foundation engineering, including bridges, turnpikes, buildings, railroads, aircraft. Desires teaching position in eastern university for the fall of 1954 in structural engineering and allied subjects. C-915.

CIVIL ENGINEER; J.M. ASCE; 34; married; 5 years' heavy construction field engineering and supervision on oil refinery, chemical plant and industrial building; 2 years' as mechanical trades supervisor and area superintendent. Desires permanent position with opportunity in construction or plant engineering, domestic or foreign. C-916.

CIVIL ENGINEER; A.M. ASCE; 33; married; B.S., M.S., (C.E.); multi-engine pilot; world traveled; responsible charge high level government engineering staffs; construction, operation, maintenance, airfields, utilities, structures; 3 years' Arctic; energetic; ambitious; want to work for top job or partnership in engineering or construction firm; will travel; will relocate. C-917.

SENIOR DESIGNING ENGINEER; M. ASCE; M.S.C.E.; 45; married; registered professional engineer. Twenty years' experience structural design, dams, bridges, heavy hydraulic structures, investigations, estimates, design, specifications and reports. Available immediately. Location preferred, West. C-918-5311-A-9-San Francisco.

CIVIL ENGINEER; J.M. ASCE; single; B.S. in C.E., 1949; registered civil engineer; 4½ years' experience in municipal engineering, the last two of which have been in research and field work in ground water hydraulics and well construction. Desires responsible position in some phase of ground water utilization. C-919-768-Chicago.

CIVIL ENGINEER; J.M. ASCE; B.S. in C.E.; 29; married; 8 years' varied engineering experience, domestic and foreign, including field engineering, mapping, estimating and contract administration for airfields, highways, pipe lines and dams. Available on 30 days notice. Location, far west. C-920-5312-A-3-San Francisco.

CIVIL ENGINEER; J.M. ASCE; B.C.E., 1951; 26; married; 2½ years' experience in water supply and sewerage field and office work; desires responsible position with opportunity for advancement in which college training in structural analysis and related subjects would be used to advantage under experienced supervision. Would consider offer in sanitary engineering. C-921.

Positions Available

ASSISTANT CITY PLANNER with college training in city planning, engineering or both. Several years' experience in zoning, mapping and land subdivision. Salary, $5,650 a year with four annual increments of $150 a year. Location, upstate New York. Y-9337.

PROFESSOR in civil engineering. Duties involve the teaching of such courses as surveying, structural design and sanitary engineering. Position open to recent graduates. Salary and academic rank open depending on degree and experience. Position starts January 15, 1954. Location, Kansas. Y-9339.

CIVIL OR MECHANICAL ENGINEER, graduate, about 30, with basic knowledge of production processes, controls and design, to engineer and expedite mechanical, optical precision instruments and obtain customer reaction. Location, New Jersey. Y-9381.

CIVIL ENGINEER, 30–35, graduate, to supervise cadastral surveying project. Knowledge of Spanish and foreign area survey experience desirable. Salary, $8,000–$10,000 a year. Location, Philippines. F-9412.

INSTRUCTORS, young, with at least a B.S. in civil engineering; M.S. preferred. Should have some background in either soil mechanics or sanitary engineering. Would like veteran recently discharged. Salary, from $4,000 a year depending on education, etc. Additional compensation for evening and summer session work. Positions start February 1, 1954. Location, New York Metropolitan area. Y-9429.

GRADUATE AND RESEARCH ASSISTANTS in civil engineering department. Will do half time research work or assist in the instruction in the following fields: structural steel, prestressed concrete, hydraulics, materials testing laboratory, engineering drawing. Should obtain M.S. in 2 years. Salary, $120 a month plus tuition. Location, Middle Atlantic state. Y-9432.

SENIOR HYDRAULIC ENGINEERS, graduates, with 3 or more years' experience in the field of hydraulic structures, hydrology or related work. Starting salary, $4,980 a year and up depending on qualifications. Location, New Jersey. Y-9454.

GENERAL ENGINEER, 30–55, to work on township planning board, keep maps up to date, do surveying work, etc. Must have had several years' experience along above line. Salary open. Location, New Jersey. Y-9464.

CIVIL ENGINEER, with sanitary engineering experience covering water works, pipelines or municipal engineering. Knowledge of Spanish desirable. Salary, $6,000–$8,000 a year. Location, Colombia, South America. F-9478.

SANITARY ENGINEER, licensed or eligible for examination for license, to practice professional engineering in New York State. Degree in sanitary or public health engineering and 4 years' public health engineering experience; or, degree in civil or chemical engineering and 6 years' public health engineering experience; or, any combination of education, experience and training which is determined to be the equivalent of either of the above. Location, New York State. Y-9497.

DESIGNER with experience on railroad bridges. Must be able to make field inspections, analyze structures, make capacity ratings and prepare plans. Salary open. For railroad in northern New England. Y-9505.

ENGINEERS. (a) Erection Superintendent, tanks; to 50, with at least 1 year's experience in the field erection of steel tanks. Will supervise the erection of steel tanks. Salary, $6,000–$8,400 a year. Employer will negotiate fee. Some travel. Headquarters, Chicago, Illinois. (b) Assistant Plant Superintendent, to 35; with at least 1 year's experience in steel tank building and preferably in job shop operations. Knowledge of general shop practices. Will assist shop superintendent in the manufacture of steel tanks. Salary, $6,000–$7,200 a year. Employer will negotiate fee. Location, Chicago. C-1416.

MECHANICAL, MINING OR CONSTRUCTION ENGINEER, graduate, to 50. Ten years' experience. Will supervise 300–400 multi-plant operation. Executive production manager to direct, oversee and control large volume distribution of limestone aggregates, sand and compounded redimix concrete. Background in design of equipment used in quarries, superintendent of quarry operation or large construction experience preferred. For manufacturer of quarrying limestone products. Salary starts at $10,000 a year. Employer will pay fee. Location, Illinois. C-1488(a)

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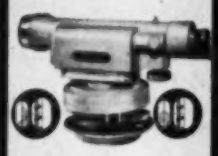

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Yes, it is my plan to attend the Atlanta Convention, with .... guests. Please reserve for my use the following tickets, which I shall pick up when I arrive and register:

FUNCTION	NUMBER OF TICKETS
Wednesday, Feb. 17	
Luncheon	.....
Ladies bus tour	.....
Icebreaker Party	.....
Thursday, Feb. 18	
Ladies bus tour	.....
Luncheon	.....
Men's tour	.....
Dinner Dance	.....
Friday, Feb. 19	
Ladies Brunch	.....
Hydraulics Luncheon	.....
Sanitary Engineering Luncheon	.....
Student's Luncheon	.....
Students' Dinner Dance	.....

Non-ASCE Meetings

American Institute of Electrical Engineers. The winter general meeting of the AIEE will take place at the Statler Hotel, New York City, January 18–22.

American Society of Photogrammetry. Featured at the 20th annual meeting of the American Society of Photogrammetry (Shoreham Hotel, Washington, D.C., January 13–15) will be an address by Ralph A. Tudor, M. ASCE, Under Secretary of the U.S. Department of the Interior.

Canadian Conference on Prestressed Concrete. Sponsor of the Canadian Conference on Prestressed Concrete, to be held at the Hart House Theatre at the University of Toronto, January 28 and 29, is the Extension Department of the University, with Prof. C. F. Morrison, of the department of civil engineering, acting as chairman.

Chi Epsilon. A meeting of the New York Alumni Chapter will be held in the Engineering Societies Building, Room 1101, February 3, at 7:30 p.m. It will be preceded by an informal dinner in the New York Times Dining Room, 11th floor, 229 West 43rd St., at 6 p.m.

Conference on Operations Research in Production and Inventory Control. The Case Institute of Technology is bringing together on its campus, a group of experts to present methods and results of the applications of operations research to production and inventory problems, at a three-day conference, January 20–22. The $100 registration fee includes admission to all sessions, lunches, smokers, and banquets, but not lodging. Accommodations are available at the Wade Park Manor near the Case campus.

Cornell Society of Engineers. A buffet supper and meeting of the Cornell Society of Engineers will be held at the Engineers Club, 32 West 40th St., New York, N.Y., on January 21, at 6:30 p.m.

Highway Research Board. The Highway Research Board will hold its 33rd annual meeting in the building of the National Academy of Sciences and the National Research Council, Washington, D.C., January 12–15.

Fourteenth Annual Land Surveyors Conference and Exhibition. The fourteenth annual Land Surveyors Conference and Exhibition, sponsored by the Land Surveyors Division of the New Jersey Society of Professional Engineers, will take place at the Rutgers University Commons, New Brunswick, N.J., January 23.

Instrument Society of America. Headquarters for the ninth annual Regional Conference of the Instrument Society of America will be the Hotel Statler, New York, N.Y., February 4.

National Association of Corrosion Engineers. In cooperation with the Division of Industrial Services at Washington State College, the National Association of Corrosion Engineers will present a five-day course, February 1–5, on the campus of Washington State College. The program includes five general topics—fundamentals, practical aspects, corrosion mitigation, materials of construction, and environment.

Plant Maintenance & Engineering Conference and Show. The Plant Maintenance & Engineering Conference will meet at the Hotel Conrad Hilton, Chicago, Ill., January 25–28, while the engineering show will take place concurrently at the International Amphitheatre in Chicago.

Society of Automotive Engineers. The 1954 annual meeting of the Society of Automotive Engineers will be held at the Hotel Statler and the Sheraton-Cadillac Hotel, Detroit, Mich., January 11–15.

Third Annual Georgia Highway Conference. The campus of the Georgia Institute of Technology will be the scene of the third annual Georgia Highway Conference, February 1–3. The conference is jointly sponsored by the School of Civil Engineering and the Georgia State Highway Department.

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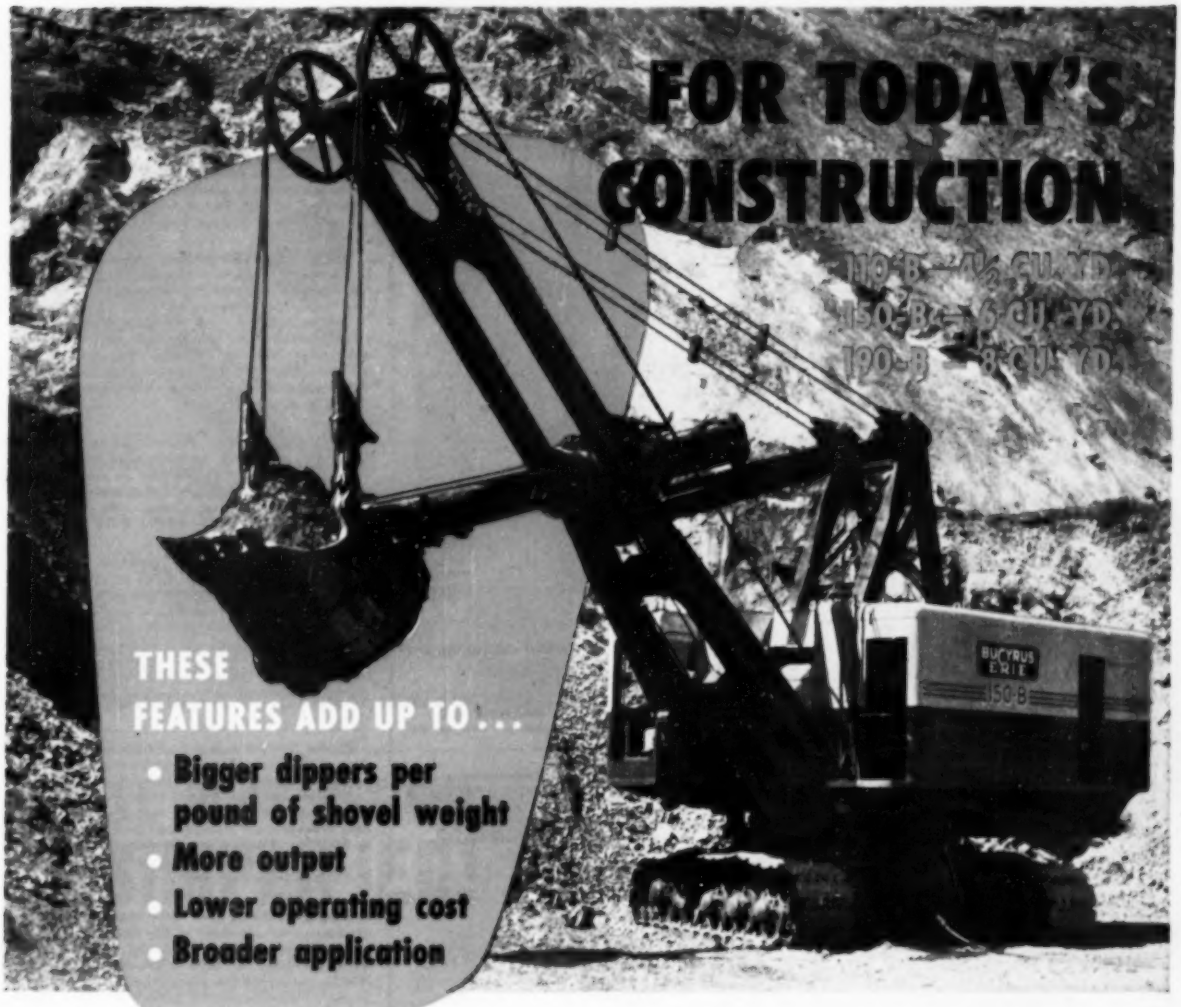
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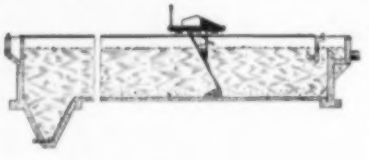

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New Publications

Column Analysis. Results of a cooperative investigation of bridge types—conducted by the Bureau of Public Roads and the Texas Engineering Experiment Station—are reported by Henson K. Stephenson, M. ASCE, and Kriss Clonger, Jr., J.M. ASCE, research and assistant research engineer at the Texas Engineering Experiment Station, in the Station's Bulletin 129. The 287-page publication represents a practical guide to the more important developments of the past thirty years in the field of stress analysis and design of columns and other compression members. Inquiries should be addressed to the Texas Engineering Experiment Station, College Station, Tex.

Engineering Bibliography. A recommended list of basic periodicals in engineering and the engineering sciences, prepared by the Association of College and Reference Libraries, has been issued as ACRL Monograph No. 9. All the monographs are separately priced to be sold at cost, with the present publication listed at 75 cents. Inquiries should be addressed to ACRL Monographs, c/o the University of Illinois Library, Chicago Undergraduate Division, Chicago 1, Ill.

Industrial Wastes. Proceedings of the Second Southern Municipal and Industrial Waste Conference are now available and may be purchased from the Department of Sanitary Engineering, University of North Carolina, Chapel Hill, N.C., at $1 a copy.

Prestressed Concrete. Practical solutions to some of the problems involved in the design and construction of prestressed concrete structures—presented at the Western Conference on Prestressed Concrete held in Los Angeles in November 1952—are now available in the conference proceedings. Inquiries should be addressed to the Department of Conference and Special Activities, University Extension, University of California, Los Angeles 24, Calif.

Traffic Studies. A factual approach to the solution of traffic problems is set forth in a completely revised and expanded edition of the *Manual of Traffic Engineering Studies* prepared by the Association of Casualty and Surety Companies. The new manual may be purchased from the Association at 60 John Street, New York 28, N.Y., at $3.75 a copy in quantities under ten, and at $3.30 a copy if more than ten are ordered.

Photogrammetry Kit. For the convenience of students, two members of the Cooper Union engineering faculty—John O. Eichler, M. ASCE, associate professor of civil engineering, and Harry Tubis, instructor in photogrammetry—have prepared a Photogrammetry Laboratory Kit consisting of a series of laboratory problems in the field and photos containing horizontal and vertical control. After many years of using photographs taken at various altitudes, the authors decided that a flight made at 4,800 ft with a 12-in. lens would provide scale and image detail most useful to the beginner. A special flight was planned and flown, and the accompanying photographs have been selected from this flight of 21 exposures. The photographs offer opportunity for advanced research problems, in addition to the basic exercises. The complete kit sells for $5.25, and is available upon application to Photogrammetry Laboratory Kit, 47 Clinton Street, Newark 2, N.J.

ASTM Research. Availability of free copies of a 22-page pamphlet made up of reprints of the "Review of ASTM Research," as published in ASTM Bulletins, is announced by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. Prepared by the ASTM Administrative Committee on Research, the material summarizes the work of the various technical committees of the society as of May 1953.

Technical Data Catalog. More than 2,000 subjects are listed in the new Lefax Catalog of pocket-size technical data books for handy on-the-job reference. Covering every branch of engineering, the books (about 140 pages each) are continuously revised to keep abreast of current advances. All Lefax Data Books sell at $1.25 each. A free catalog is available from the publisher, Lefax, Philadelphia 7, Pa.

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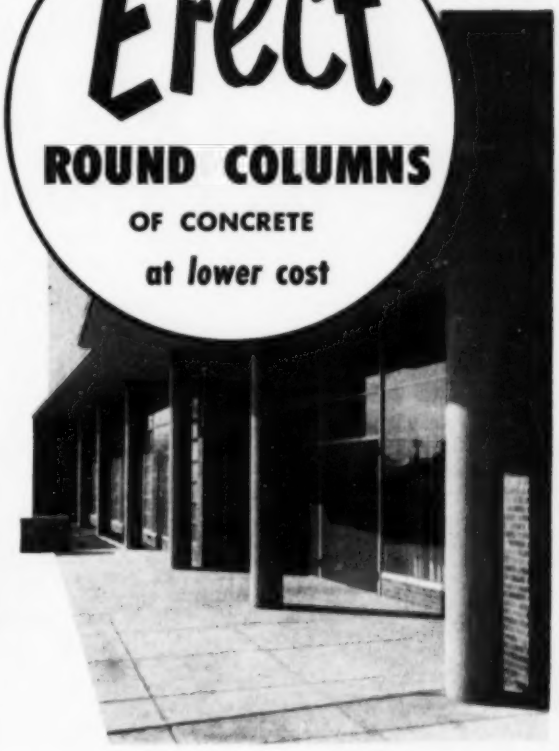

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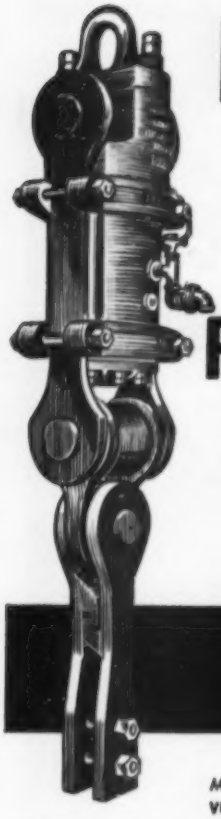

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Applications for Admission to ASCE, November 14–December 5

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JOE MENDELSOHN ABRAMSON, Shreveport, La.
RAM BALLAV CHAKRAVARTY, West Bengal, India.
FREDERICK DAVIS DAY, New York, N.Y.
FLOYD FRANK FORD, Walla Walla, Wash.
JOHN WILSON FURLOW, Philadelphia, Pa.
GUY GLEN GAGE, Caracas, Venezuela.
CLINTON OTIS HENNING, Sacramento, Calif.
HARRY HOWARD, JR., Jacksonville, Fla.
JOHN HAROLD JOHNSON, Wheaton, Ill.
WILLIAM JOHN KOENIG, New York, N.Y.
JOHN ROGERS MARTIN, Oklahoma City, Okla.
CHARLES KENNETH MCCRACKEN, New York, N.Y.
RICHARD RUTHERFORD RANDOLPH, JR., Birmingham, Ala.
RALPH HENRY SARTOR, Youngstown, Ohio.
RAYMOND WASHINGTON SCHMIDT, Mobile, Ala.
HAROLD HENRY SORENSON, Omaha, Nebr.
GARLAND FREDRICK STEELE, Atlanta, Ga.
ALBERT EDWARD STOLTZ, New York, N.Y.
JAN CHRISTIAAN VAN TIENHOVEN, Vicksburg, Miss.
WILLIAM HENRY WOLF, Denver, Colo.
WILLIAM ESSER YODER, Reading, Pa.

Applying for Associate Member

CHARLES EDWARD ALLEN, JR., Paducah, Ky.
CHARLES WOODS BAXTER, San Antonio, Tex.
JOSEPH LYNDON BOYD, Houston, Tex.
HARRY ALLAN BURKE, Nashville, Tenn.
WILLIAM DAVID BYRD, Richland, Wash.
CRAIG JOHN CAIN, Chicago, Ill.
WILLIAM EUGENE CARY, Houston, Tex.
HUANG CHAO, Detroit, Mich.
ROBERT GRANT CRABTREE, Denver, Colo.
MARTIN JOHN JERVIS DAYTON, Vancouver, B.C., Canada.
JOHN DAVID DEMOLL, Philadelphia, Pa.
FRANCIS FERNAND ESCOFFIER, Mobile, Ala.
EUGENE ERNEST FLAJSER, New York, N.Y.
JOHN VINCENT FLEMING, Arlington, Va.
RETO FURRER, Sewell, Chile.
THAKURDAS CHHANGOMAL GURBAXANI, Nagpur, India.
KENNETH DEAN HENRY, Kansas City, Mo.
CHARLES CLEMONS KIRKWOOD, Aberdeen, Wash.
JAMES LOUIS LINDSEY, Albany, Ga.
MARCUS NICHOLAS MAINARDI, Newark, N.J.
HAROLD EVERETT ORFORD, New Brunswick, N.J.
HERMANN HUGO SEELE, San Antonio, Tex.
HUGH GERALD STOCKS, Pretoria Transvaal, South Africa.
SYTZE SYBRANDY, Germiston, South Africa.
COLIN FERGUS TEMPLER, Cape Town, South Africa.
YAT WAH TSUI, New York, N.Y.
GERMAN RENER WIENS, Caracas, Venezuela.
DUDLEY LIPSCOMB WILLIS, Wilmington, Del.
FRANK MICHAEL ZAGAR, Dunellen, N.J.

Applying for Junior Member

ROBERT ALEXANDER BRIDGES, North Highlands, Calif.
RICHARD CHARLES CALLAGHAN, Washington, D.C.
ANTONIO JUAN CELIS, Ithaca, N.Y.
ROBERT CUCCIOLO, New York, N.Y.
DEAN ALLEN DAVIS, Dubuque, Iowa.
LOUIS PAUL DIMATTEO, New York, N.Y.
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KEITH LEE GUTHRIE, Indianapolis, Ind.
MYRON BERNARD HOLBURT, Gulfport, Miss.
BOHDAN IVAN MADUKE, Vancouver, B.C., Canada.
PHILIP MCCALLISTER, Buffalo, N.Y.
BILLY JOE MCCLEAREN, Fort Worth, Tex.
WILLIAM EDWARD MONAGHAN, Yohosuka, Japan.
MANUBHAI N. PATEL, E. Lansing, Mich.
DARIO RESTREPO-T, Harrisburg, Pa.
JOHN EDWARD WAGNER, Little Rock, Ark.
THEODORE YOSHISADA WAKAI, Easton, Pa.
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[Applications for Junior membership from ASCE Student Chapters are not listed.]

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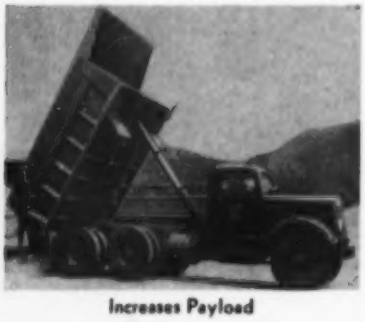
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Telescopic Truck Hoist

PROVIDING UP TO 1000 lbs extra legal payload, a front-mounted telescopic truck hoist is now being marketed. Designed especially for heavy-duty dump truck bodies 11 to 15 ft long, this 20 ton capacity hoist shifts hoist weight forward. Thus



Increases Payload

more load is on the front axle, making possible maximum per-axle loads. Available through Hercules distributors throughout the U.S., the telescopic hoist is manufactured for single or tandem axle straight trucks. It is easily mounted with no part of the hoist extending below the truck frame. Because it is lighter in weight than many other types of hoists, contractors and material haulers can get jobs done faster through a decrease in "dead weight" and an increase in legal payload. **Hercules Steel Products Corporation, CE 1-110, Galion, Ohio**

Trencher

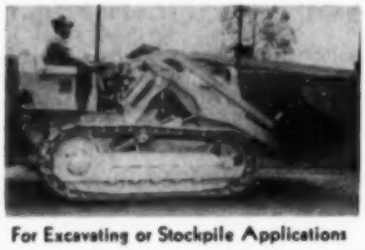
LOW-COST, HEAVY-DUTY equipment for speedy and neat trenching of gas and water mains, service lines and irrigation and drainage ditches has now become a reality. Rugged and practical, the Universal Trencher is the result of tests and observations of nearly thirty different machines over a three-year period under actual conditions. Cleverly contrived with only standard parts for ease of assembly, replacement and repair, the 3A-48 Model is specifically designed for mounting on the Oliver OC-3 crawler tractor. Some features include 4 ft depth of excavation, digging width control with bolt on clearance teeth, six digging speeds, adjustable and reversible soil conveyer, hydraulic control for fingertip operation, safety clutch and hydraulically-controlled backfiller blade. The trencher mounts the versatile Oliver tractor with perfect balance and the side mount for the operator with his controls readily at hand assure perfect operator vision and straight-line trenches without operator fatigue. **Heller Engineering & Mfg. Co., CE 1-110, 11752 South Alameda St., Lynwood, Calif.**

Calculator

INTRODUCED AS A unique time-saver is the Morton's Area and Volume Calculator. Operating like a slide rule, but reading like a table, this pocket style calculator gives areas or volumes to the nearest square foot. As a result, the user can obtain instantly and accurately the areas of walls, ceilings, floors and windows. In addition, the device reduces to a fraction the time required in determining the cubic footage (volume) of a room. By setting one dimension in the window and referring to the figure under the other known dimension, the user of the calculator reads directly the area figure. Window-areas—either by opening size or glass size—are found in a similar manner with the aid of a sliding sleeve on the device. This external runner is also used in finding volumes. The floor area is set under an arrow on the back of the calculator, and then the user reads directly on the same line the volume in cu ft under a choice of ceiling heights. Five different scales appearing along the edges make the calculator additionally useful. It measures 3¾ by 9 in. in size, and is of lifetime vinyl plastic. **Paul S. Morton Engineering Service, CE 1-110, 609 Bangor Road, Lawrence, Mich.**

Bucket

AN IMPROVED standard bucket for the HT4 shovel has been developed. The two-position bucket will provide greater

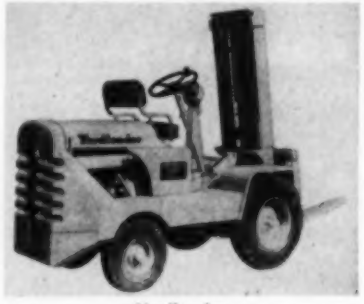


For Excavating or Stockpile Applications

flexibility because of an adjustable pitch and a deeper bowl. This will make the unit ideal for either excavating or stockpile applications. The two positions now available are achieved by changing the removable pins on each side of the bucket to either the forward or rear hinge points. The forward hinge point for stockpiling gives quicker tilt-back and less spillage because of a 10 deg rack-back at the ground line. A simple adjustment connecting the bucket to the rear hinge point retains the former digging and dumping angles desirable for excavating work. Redesigned bucket teeth are also available for the improved bucket, now standard equipment on the Caterpillar HT4 shovel. **Caterpillar News Service, CE 1-110, Caterpillar Tractor Co., Peoria 8, Ill.**

Fork Truck

DEVELOPMENT OF A low-cost gasoline engine 4000 lb fork truck designed for outside or rough-surface work—and featuring a travel speed of 14 mph—has been announced. Its high travel speed makes it particularly valuable for yard handling



Yardloader

jobs requiring the movement of materials over large areas. Large pneumatic tires and an exceptionally high ground clearance are additional Yardloader features which suit the new truck for yard handling operations. Also, the Yardloader uses an extra heavy drive axle and an oscillating trail axle to permit its operation over unimproved or semi-improved surfaces. Powered by a valve-in-head Case industrial engine, the Yardloader has a standard lifting height of 122 in. The truck uses a low-pressure hydraulic system. Its motor-driven gear pump supplies oil under pressure to either lifting or tilting cylinders, with speed controlled by acceleration of the engine; excess is by-passed to the reservoir. Oil is transmitted through high-pressure oil proof hose. **The Baker-Raulang Company, Baker Industrial Truck Div., CE 1-110, 1230 W. 80th St., Cleveland 2, Ohio**

Generators

A NEW GROUP of 1800 rpm emergency power generators designed to combat the crippling effects of a power failure is annouced. The generators range in sizes of from 2000 watts to 15,000 watts, easily belted to the ordinary farm type tractor or any other speed governed engine power. They develop the same 115/2300 voltage as supplied by the highlines and come in two designs: revolving armature and revolving field. The latter having a separate direct connected exciter, is particularly noted for its exceptional overload and motor starting ability. A standard pulley and panel complete with a voltmeter and rheostat can also be supplied along with necessary approved transfer switches. The generators are also available in 3 phase characteristics. **Katolight Corporation, CE 1-110, 624 North Front St., Mankato, Minn.**

Equipment, Materials & Methods (Continued)

Hydraulic Crane

AN INDOOR-OUTDOOR hydraulic crane which combines the best features of crawler, truck and erection cranes with those of industrial shop cranes, is self-propelled and hydraulically operated. Four functions are involved: turntable rotation, boom elevation, raising and lowering of cable and hook, and power extension and retraction of the boom. All movements, including steering, are actuated by hydraulic power. The crane, although completely new to industry, is actually an adaptation of a machine originally designed for use by the U. S. Navy. The lightweight, fast moving crane proved so successful that Austin-Western decided to make it available for civilian use in and around factories, repair shops, warehouses, docks, mines, rail yards and airports. Before beginning production of the civilian crane, however, a comprehensive survey was conducted throughout industry by one of the nation's foremost research organizations to determine the characteristics required in a machine of this type. After a complete analysis of the survey was made,

Designed for Easy Installation

the final features and specifications of the crane were established. It was decided that features such as 360 deg boom rotation; 24 ft horizontal reach from center of rotation; 24 ft vertical lift from ground level to hook; ability to negotiate grades up to 20 percent, under full load; and 15 mph road speed, under full load, would make the Austin-Western hydraulic crane the kind of machine that industry had asked for to meet its hundreds of materials handling needs. The crane's overall height of 9 ft and overall width of 8 ft were also established as a result of the survey which showed that these dimensions would meet door and aisle requirements in the vast majority of cases. **Austin-Western Company, CE 1-111, Aurora, Ill.**

Pole Grip

A COMPLETELY NEW patented tool used for setting power poles up through energized power lines is now in production. This revolutionary tool, known as Pengo Pole Grip does not replace the peavey; but does a different job. It enables one man to have complete control of the butt of the pole to safely guide the top of it up between power lines and therefore, it not only eliminates one man, but is a safety tool as well. **Petersen Engineering Co., Mfgs., CE 1-111, Santa Clara, Calif.**

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It has been demonstrated under rigid test conditions that increases in incinerator plant capacities up to 50% are obtainable along with 50% lower labor cost per ton burned. Information concerning these tests, descriptive literature, and technical information are available. Write today . . .

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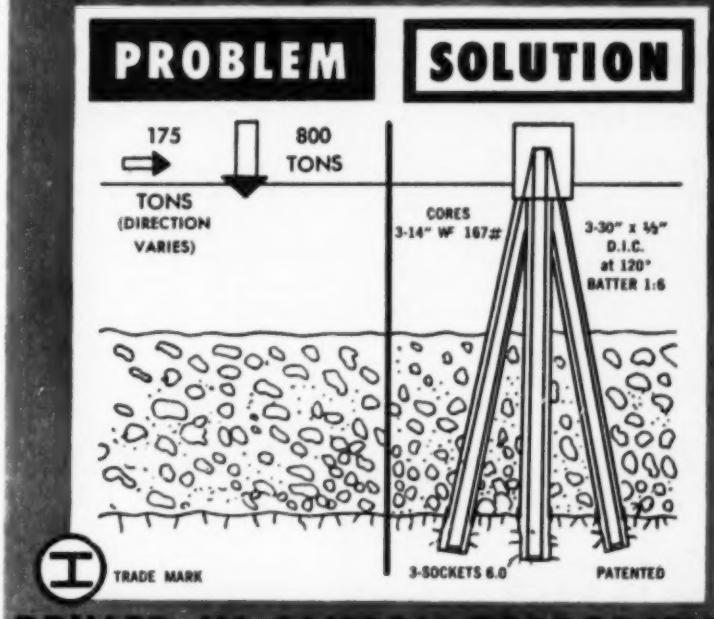

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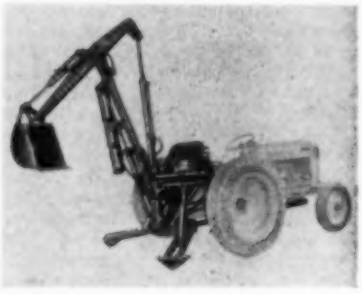
Equipment, Materials & Methods (Continued)

Hydraulic Power Digger

DESIGN AND ENGINEERING advancements in latest models of Sherman hydraulic power diggers assure extra performance, greater economy and durability. Major improvements, proved in many months of severe testing under actual operating conditions, are designed principally to assure longer life of the equipment and freedom from service regardless of hard



usage. The dipstick, for instance, is now of fabricated box construction, insuring added strength to meet the most severe operating conditions. The safety factor has been measurably increased. Booms have been reinforced and have nearly 100 percent greater bearing surface at hinge points on the dipstick and swing frame for longer life of pins and bearings and smoother operation. A redesigned swing control system provides better throttling control and positive, smooth action as fast or slow as operating conditions require. Hoses with double wire braid for maximum assurance against failure are now standard equipment, and a new hose arrangement reduces the possibility of chafing and cramping. A simplified regulating valve replaces the flow-control valve in the crowd cylinder circuit, still another measure contributing to long, trouble-free life. New, self-leveling hydraulic stabilizers are another outstanding improvement. These act separately instead of in unison, thus conforming to the terrain in which the digger is being operated, regardless of irregularities of the surface soil. This feature makes it possible to dig plumb on slopes. A new design and the method of mounting distributes the thrust of the digging operation, imparting a cushioning effect which relieves direct strains on the entire unit, tractor as well as digging equipment. On some models, this requires the use of steel channels extending from the lower extremity of the main frame assembly to the front of the tractor where it is attached to the tractor frame. In other cases, mounting of the sub-frame is altered to conform with the design of the tractor. In all cases, however, mounting of the digging equipment directly to cast iron members of the tractor is avoided, thus providing a new quality of elasticity that still further relieves direct strains. **Sherman Products, Inc., CE 1-112, Royal Oak, Mich.**

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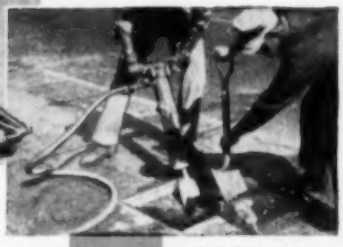

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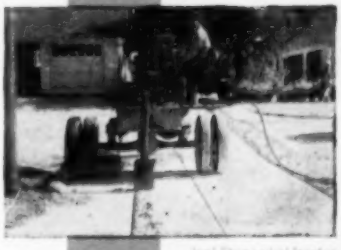

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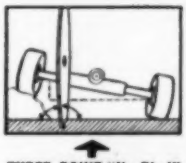

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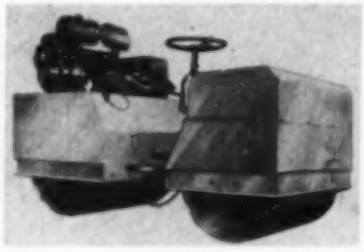
Equipment, Materials & Methods (Continued)

One-Ton Roller

A RECENTLY DESIGNED one-ton Motoroller having 56 lbs per sq in. compaction is now ready for production and will be on the market early in the Spring of 1954. Some of the features of the Motoroller are a newly designed center poise hook-up which insures perfect tracking of the front and rear rolls; geared steering through a



Motoroller

split front drum; low center of gravity for working on grades and slopes; compact frame structure with a minimum of overhang on sides for close rolling; water ballast drums to permit weight variance; dual drain plugs for speedy filling and draining; Wisconsin air cooled engine, providing a smooth flow of extra power; and proven heavy duty forward-reverse transmission with external adjustments. **Gabb Special Products, Div. of the E. Horton & Son Company, CE1-114, Windsor Locks, Conn.**

Wall Brace

A TILT UP WALL brace, designed for fast and efficient bracing, adjusting and plumbing of precast concrete wall panels, is made of lightweight tubing and is adjustable from a 12 ft length to a 22 ft length. It has two types of standard end fittings, one type is a unique quick attach unit, designed for a ball and socket attachment with the ball furnished with the brace. The other end fitting is interchangeable and can be used with all standard imbedded inserts. This new brace does away with unsafe, inefficient and more costly methods of wall slab bracing. It is now possible to brace to a standard wall panel with one brace with this new, high quality, high strength brace. A special bulletin describing it and other equipment especially designed for tilt up, precast concrete operations is available. **F. Thomas Collins & Assocs., CE 1-114, 921 West Las Tunas Drive, San Gabriel, Calif.**

When Requesting Literature Please Tell The Manufacturers You Saw Their Products Mentioned in Civil Engineering

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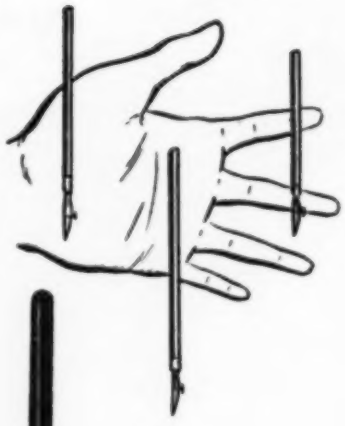

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Equipment, Materials & Methods (Continued)

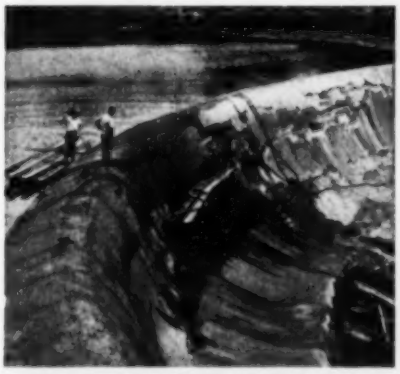
Double Pentagonal Prism

AN EXCEEDINGLY USEFUL time and labor saving device, especially for surveying, is the Double Pentagonal Prism. It bends the line of sight 90 deg in both directions,

putting the observer on a straight line between two points. Prism can be used to measure all 90 and 180 deg angles on property survey. Instrument is about the size of a plumb-bob but weighs much less. Bob is attachable to hook on bottom. **Geo Optics Company, Inc., CE 1-115, 170 Broadway, New York 38, N. Y.**

Greasing Unit

A LOW-COST, battery-powered greasing unit which pumps grease directly from the drum is being offered. The unit, trade named Greasemaster Senior, will be particularly useful to owners and operators of truck and contractors equipment and others who maintain large fleets of mobile tools and commercial vehicles. Like the earlier Greasemaster, it operates on a hydraulic ram pump (powered by an ordinary automotive storage battery) which forces grease through a 25 ft high pressure reinforced hose to a universal grease gun handle where greasing pressure can be varied from 600 lbs per sq in to 12,000 lbs. Standard automotive starter supplies mechanical power. 10 ft copper cables and high-capacity E2 battery clamps make for simple, positive power hook-up. Grease coupler works directly on all standard fittings and adaptors are available for special fittings. Ball swivel allows full 360 deg rotation and free sideways movements to reach fittings in any location. Sets up for operation in two min. Total weight of unit: 40 lbs. Two models available: Model A-100 fits drum of 14¾ in. maximum outside diameter and minimum depth of 22 in. This is the standard-size grease drum in the central states. Model A-110 fits drums of the same diameter but of at least 26 in. in depth, for the typical grease drum used in the West. Full 1-year guarantee. **G & T Industries, CE 1-115 1420 Barwise, Wichita, Kansas**



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The two photographs show the Bulls Bridge Dam of the Connecticut Light and Power Company, which is one of many dams we have repaired for this company.

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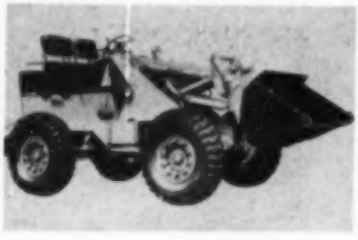
Equipment, Materials & Methods (Continued)

Shoveloader

A FRONT-END Shoveloader with 6000 lbs capacity, 4-wheel-drive and power steering, parallelogram loader action and a 100 in. wheelbase for stability has been announced. Described by the makers as "an excellent unit for jobs requiring high capacity loading under very rugged conditions," the 4-wheel-drive Shoveloader—is rated at 1 1/2 cu yd capacity with a recommended working capacity of



Powered by Hercules Engine

6000 lbs, peak capacity of 9000 lbs. The unit is equipped with positive four wheel drive and is designed to eliminate need for a center differential transfer case. Hi-flotation tires and high under-clearance permit efficient operation of the loader under extreme conditions of mud, snow, sand, and uneven ground. A 23 in. oscillation of the unit's rear axle keeps all four wheels solidly in ground contact on rough terrain, ensuring best function of the 4-wheel-drive. The Shoveloader's five speed forward or reverse transmission coupled with shuttle gear transmission permits quick change of direction when, for example, working between stockpile and truck. Power steering on all four wheels (optional) also adds to the operator's critical control of the unit. Operator safety is secured by location of the seats at the rear and above the engine, away from all moving parts. This vantage also gives the operator an excellent view ahead. Operational ease is further increased by the parallelogram design of the loader mechanism, which keeps the blade or fork at the same angle regardless of the loader's attitude. Simple adjustment of the angle is made with the tilt cylinder, when required. Power for the unit is supplied by a 6-cylinder Hercules engine—93 hp gas or 77 hp diesel at option, each rated at 2100 rpm. Special design of the Shoveloader axles, incorporating a 3-to-1 gear ratio in each wheel, lessens strain by 300 percent compared with conventional axles. **Dept. KP, Baker-Lull Corp., 314 W. 90th St., Minneapolis, Minn.**

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GANGA BRIDGE PROJECT (INDIA)

TENDER NOTICE

1. The General Manager and Chief Engineer Ganga Bridge Project, proposes to invite tenders for the construction of a Rail-cum-Road bridge across the Ganga River near Mokameh (Bihar) on the Eastern Railway.

2. Tenders will cover the following items of works for the proposed bridge:

(a) Piers and their Foundations: Foundations will be required to be taken down to a depth of 170 feet in the river bed below the low water level for the main piers.

(b) Fabrication, supply and erection of steel girders for the bridge.

(c) Reinforced concrete roadway decking on the bridge.

3. Two tentative designs have been prepared for the proposed bridge.

First: Consisting of Nine main spans of which seven will be 600 feet each, two 500 feet each and four shore spans 104'-8" each, centre to centre of bearings. The main spans will be balanced cantilever type with a 100 ft. cantilever arm at each end and 400 ft. suspended spans.

Second: Consisting of fourteen main spans each 413'-4" centre to centre of bearings and four shore spans 104'-8" each, centre to centre of bearings, simply supported at the ends.

Tenderers will be free to quote for either or for both of the above designs and for any other alternative design that they might like to suggest to the required specifications and standards of loading.

4. Site plans and other preliminary information required by intending tenderers may be obtained from the General Manager and Chief Engineer, Ganga Bridge Project, Room No. 206, 'N' Block, Raisina Road, New Delhi, on any working day after the 16th November, 1953, at Rs 25/- per set. Any additional information required can be supplied on application.

5. Intending tenderers are advised in their own interest to study all local conditions governing the works at site, availability and sources of supply of skilled and unskilled labour and suitable building materials before tendering.

6. Tender forms, together with the necessary drawings, schedule of quantities, specifications and conditions of contracts will be available for sale from 18th January, 1954, at the Project Headquarters Office at Post Office Hathidah (Mokameh, Bihar) @ Rs 100/- per set.

7. The Project Administration reserves the right to accept any tender even though not the lowest or to give all the works to one party or to split up the work between more than one party or to reject all the tenders without assigning any reason.

G. Pande

General Manager & Chief Engineer,
Ganga Bridge Project, Mokameh.
Camp Office, Room No. 206, 'N' Block
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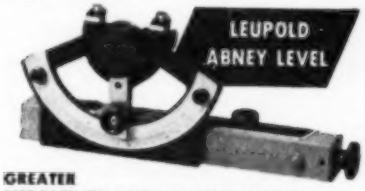

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Literature Available

CEMENT TESTER—A 50,000 lb cement tester is presented in Bulletin 4205, newly issued. Its four illustrated pages cover the evolution of the machine with development of ASTM Test Method C 109-52, and gives features and specifications. **Baldwin-Lima-Hamilton Corp., CE 1-117, Philadelphia 42, Pa.**

CRANE-EXCAVATORS—The first printing of a pocket-size technical booklet titled, "Handbook of Data for Proper Selection of Crane-Excavators," is announced. The booklet contains specific information on major design and construction fundamentals which are presented in a concise, matter-of-fact style. Actual comparison charts are included for added reading convenience. This handbook has been prepared to help make certain that the selection of a crane-excavator is the one best suited for a particular job whatever the requirement. **The Wayne-Crane Div., American Steel Dredge Company, Inc., CE 1-117, Fort Wayne, Indiana**

CONCRETE EQUIPMENT HANDBOOK—A 56-page Manual for Handling and Placing Concrete is offered as a guide to the latest approved methods. It is a condensed handbook which covers all phases of concrete construction methods from the selection of concrete through the batching and placing procedures. The booklet provides complete check lists of job specifications, job conditions and equipment. It lists the available current technical data—includes many useful tables—illustrates correct and incorrect placing methods—and shows unusual jobs and how they were solved. References to proper equipment are made throughout the manual. **Gar-Bro Manufacturing Company, CE 1-117, 2415 East Washington Blvd., Los Angeles 21, Calif.**

PUMPS—Vertical turbine pumps for the safe and efficient handling of all petroleum products and other volatile fluids are described in a bulletin. Capacities of these pumps range from 40 gph to 4,000 gph, and more for special service requirements. Various special fittings and materials are available to make them adaptable to any kind of service. **Layne & Bowler, Inc., P. O. Box 6697, Memphis 8, Tenn.**

PHOTOELECTRIC CONTROL—Two 4-page bulletins on multiple-circuit photoelectric control equipment for outdoor lighting, and particularly street lighting, are now available. One bulletin designated GEC-1210, contains detailed technical data on the equipment. This includes features and specifications, and information on installation and operation. The second bulletin, GEA-5141B, provides information on various outdoor lighting applications for the new equipment. Data pertaining to its interchangeability and operational features is included. **News Bureau, General Electric Company, CE 1-117, Schnectady 5, N. Y.**

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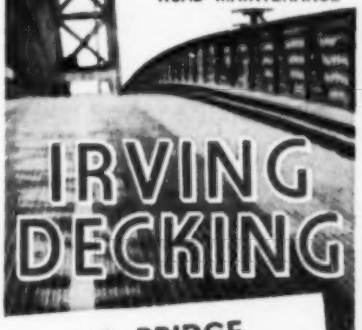

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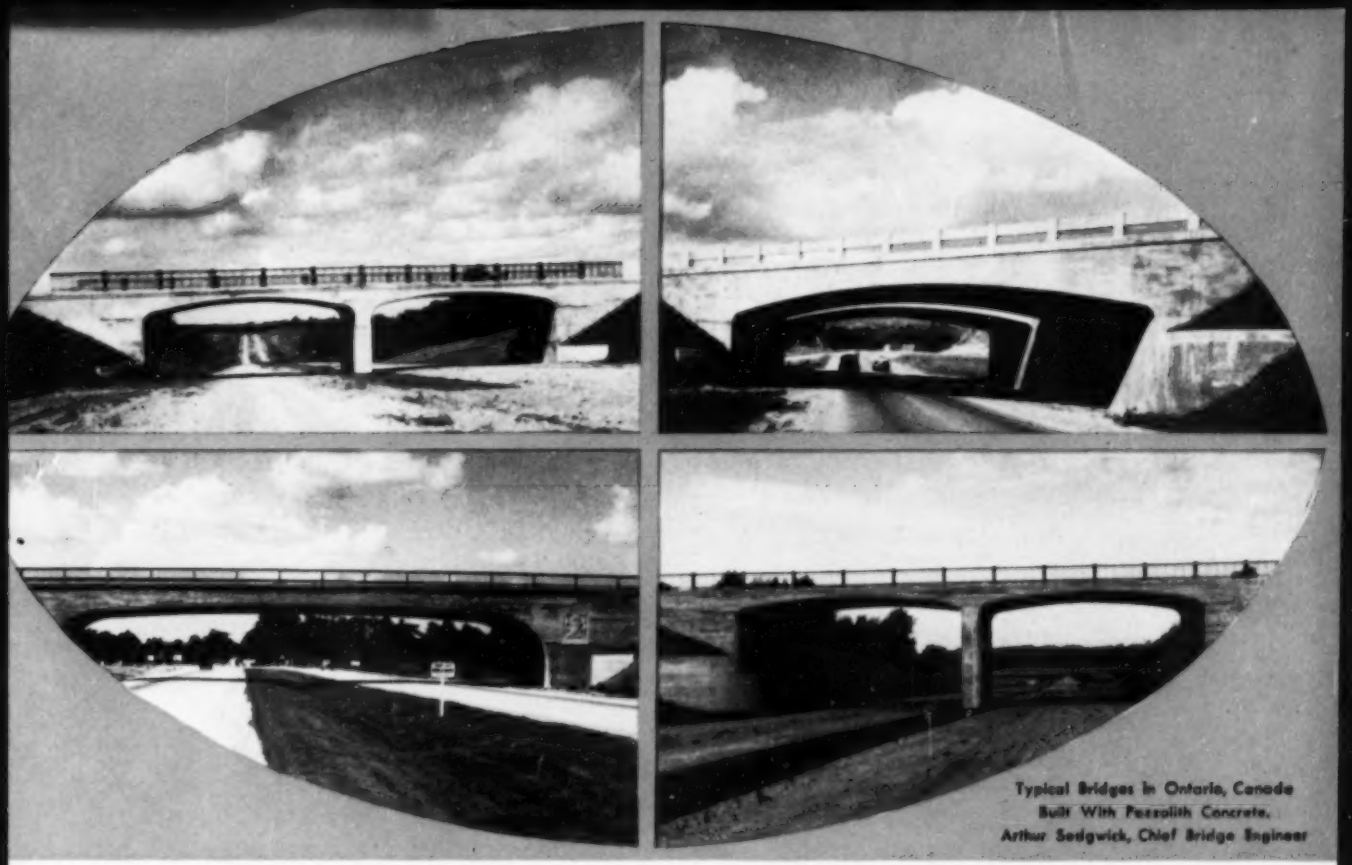

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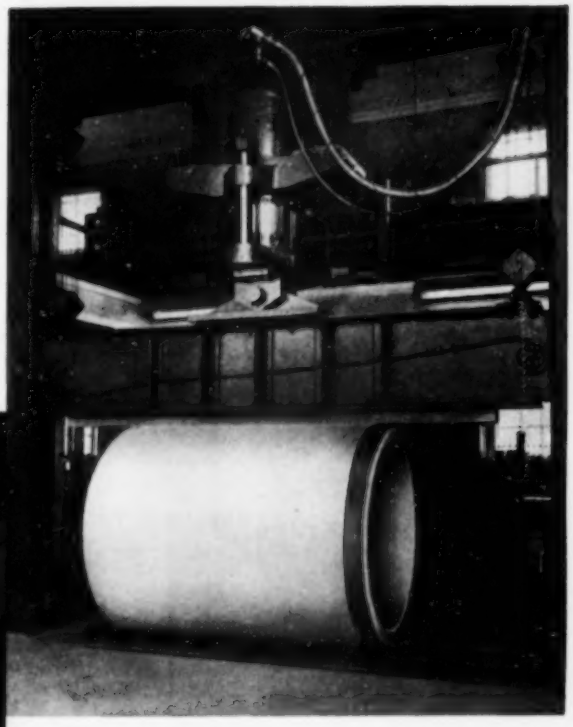

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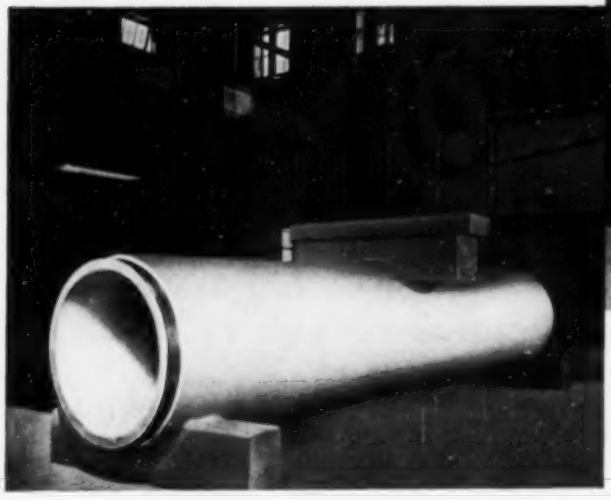

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